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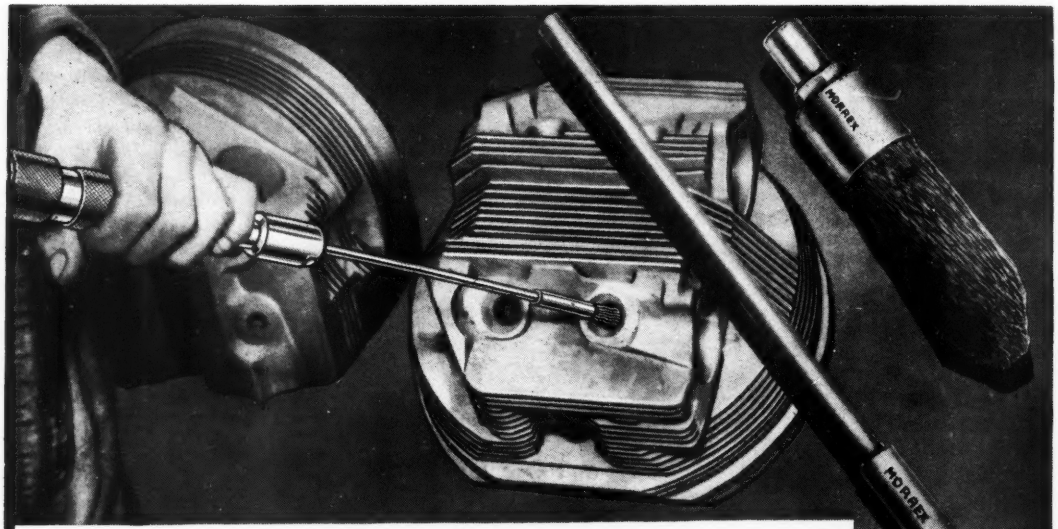

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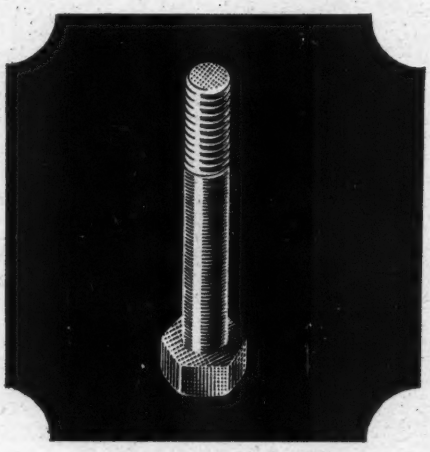

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1/2" "	3	.920"
9/16" "	3 or 4	1.010"
5/8" "	4	1.100"
11/16" "	4	1.200"
3/4" "	4 or 5	1.300"
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7/8" "	5	1.480"
1" "	5	1.670"

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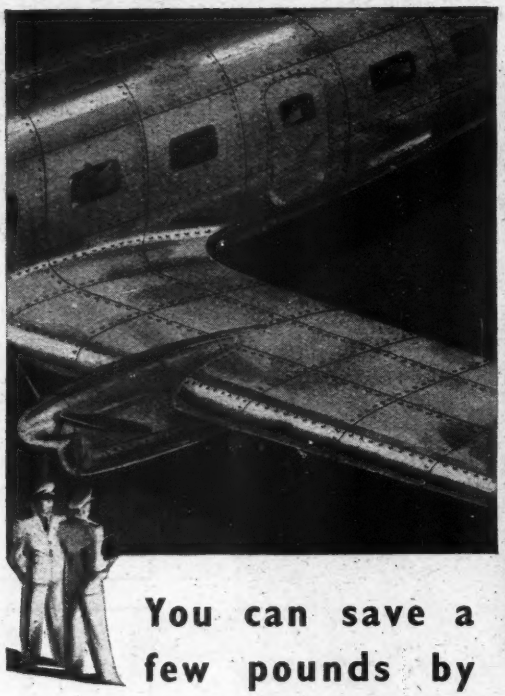

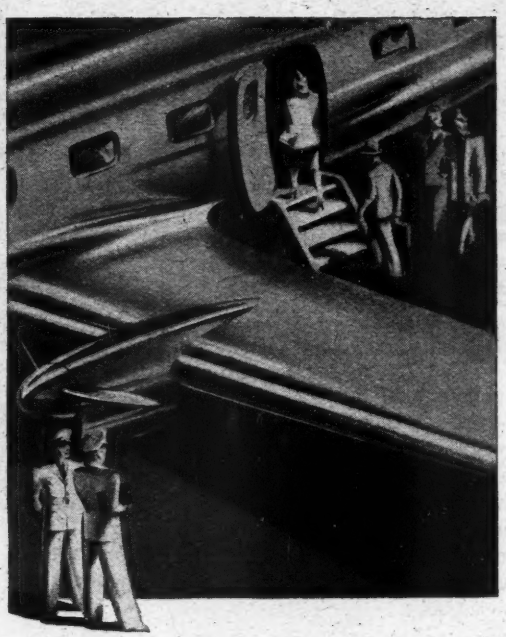

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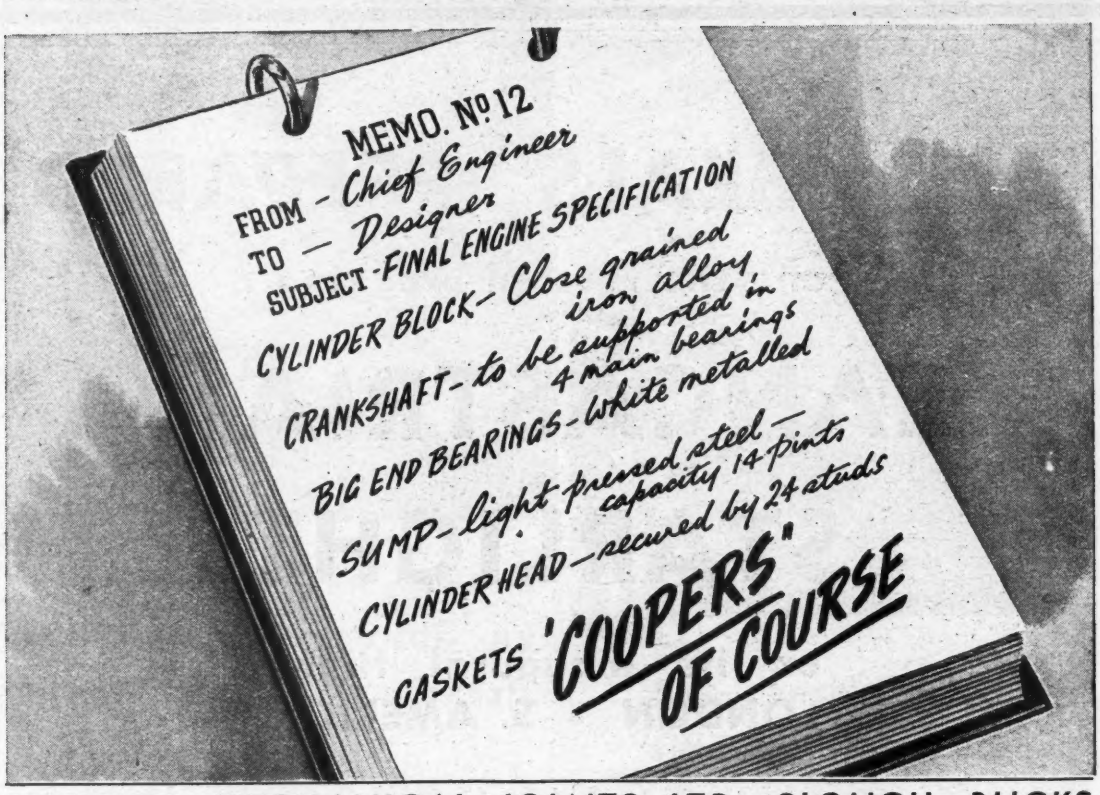
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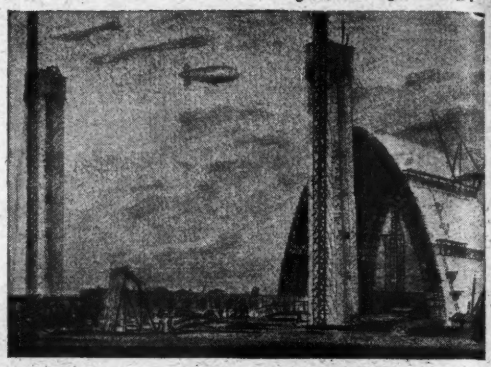

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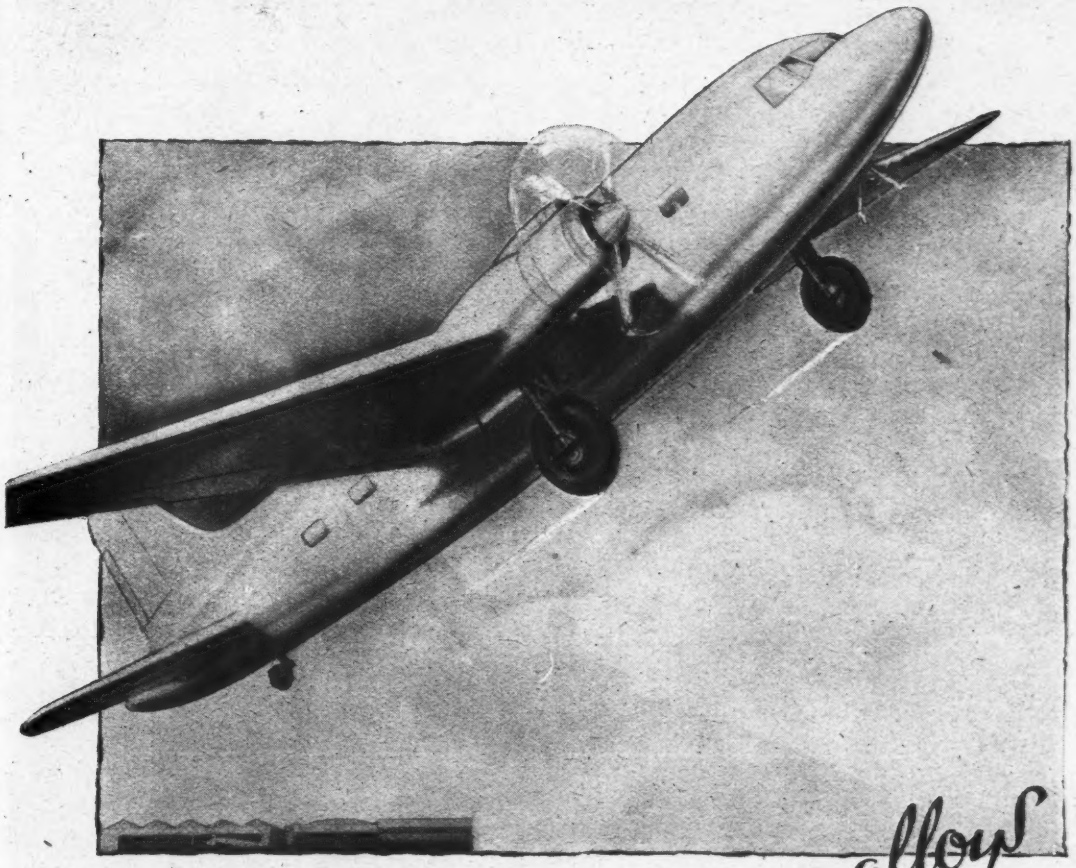

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The Outlook

The Air Trooping Programme Halved

TWO weeks ago, in an article on Transport Command's accident figures, we emphasised that it was in the trooping commitment alone that the Command had suffered such a high accident rate, and that their normal scheduled services enjoyed a very low accident figure in comparison. We also pointed out the inevitable disintegration of effort caused by the acceleration of the release scheme.

It is therefore noteworthy that these very points were strongly stressed by the Under-Secretary of State for Air in the House of Commons last week when he announced new and drastic measures which were being adopted to reduce the number of trooping accidents.

An interesting decision is the cutting of the trooping programme to and from India by 50 per cent. Mr. Strachey admits that this will cause no headaches, for sufficient shipping space has become available to cope with the remaining five thousand men each month. While we are the strongest possible advocates of air travel for all, we cannot help feeling that the sudden discovery that shipping can be made available is tantamount to an admission that trooping by air has been proving altogether too costly. The scheme was conceived as a wartime operation, and there is little doubt that, in these circumstances, the instability of ground organisations and the absence of suitable aircraft has made the whole project impractical and uneconomic as a peacetime measure.

As a result of large-scale trooping, a very large number of men and much material has obviously been tied up all along the route to India. It is not inconceivable that some of Transport Command's difficulties in manning and equipment have been caused primarily by the size of Transport Command itself, for the Command has been in the paradoxical position of having to release large numbers of key personnel whilst trying to expand its already vast organisation.

Nationalised Heterogeneity

LARGELY by dangling the carrot of jet-propelled passenger aircraft of the future in front of the House of Commons, the Government last Thursday succeeded in getting the motion to approve the White Paper carried by a two-to-one majority. A set-up which promised such alluring travel, "rushing through the air at 30,000 to 40,000ft. as comfortably as in a drawing-room," was obviously one worth supporting. Then we came down to earth with a bump when being told that twenty-five Ju-52s are to be used on our internal routes, a fact which was ironically foreshadowed in our issue of December 20th, when we published a cartoon entitled "Won't it look GRAND!"

Jesting apart, however, the debate must be said to have cleared the air considerably. Mr. Ivor Thomas, Parliamentary Secretary to the Ministry of Civil Aviation, revealed in far more detail than has previously been given how it is proposed to handle the new scheme, and the aircraft types to be used in the three stages into which development will fall. It is obvious that to start with operations cannot be very economic; there are too many different types, both conversions and others. That need not be a serious objection. Of far greater importance just now than maximum efficiency is the sheer need to get started without delay. Equipment will improve as time goes on and new types become available in increasing numbers. We particularly welcome the considerable numbers of flying boats which it is intended to use, and in this connection it was interesting to be reminded that no fewer than thirteen C-class boats and one G-class are still in service—a high tribute to the sturdiness of the Short designs.

The announcement that five Constellations are to be bought has caused some misgivings in certain quarters. We do not agree that this is likely to do any permanent harm to British aviation. On the contrary, the operation of these machines will give us the fullest possible

information about the type, and we shall be able to find out if it really is as good as it is claimed to be. Five machines out of the large total of types to be used are not likely to cause trouble when it comes to replacement. It is a different matter when an air line is completely equipped with a single type of aircraft, with all its spares. Then its replacement does become a problem.

We are, of course, assuming that so soon as the Avro Tudor I has been thoroughly tested on the route and is available in sufficient numbers, the American aircraft will be withdrawn from the Atlantic service, and that the Government will not take the view that, because a great deal of money has been expended on these machines, we must continue to use them. We are also taking it for granted that every possible assistance will be given by the Government departments concerned to expedite the construction of the British aircraft.

Getting Into the Air

As a first step towards really making a start comes the announcement of the foundations of the new corporations, and the appointment of their chiefs. British South American Airways, Ltd., are to be taken over by B O.A.C. so as to be state-owned, and in due course will be a separate corporation under the same name but with "Ltd." omitted from its title. Both shipping and air experience will be available at the top, with Mr. James Booth as chairman and Air Vice-Marshal Bennett as chief executive.

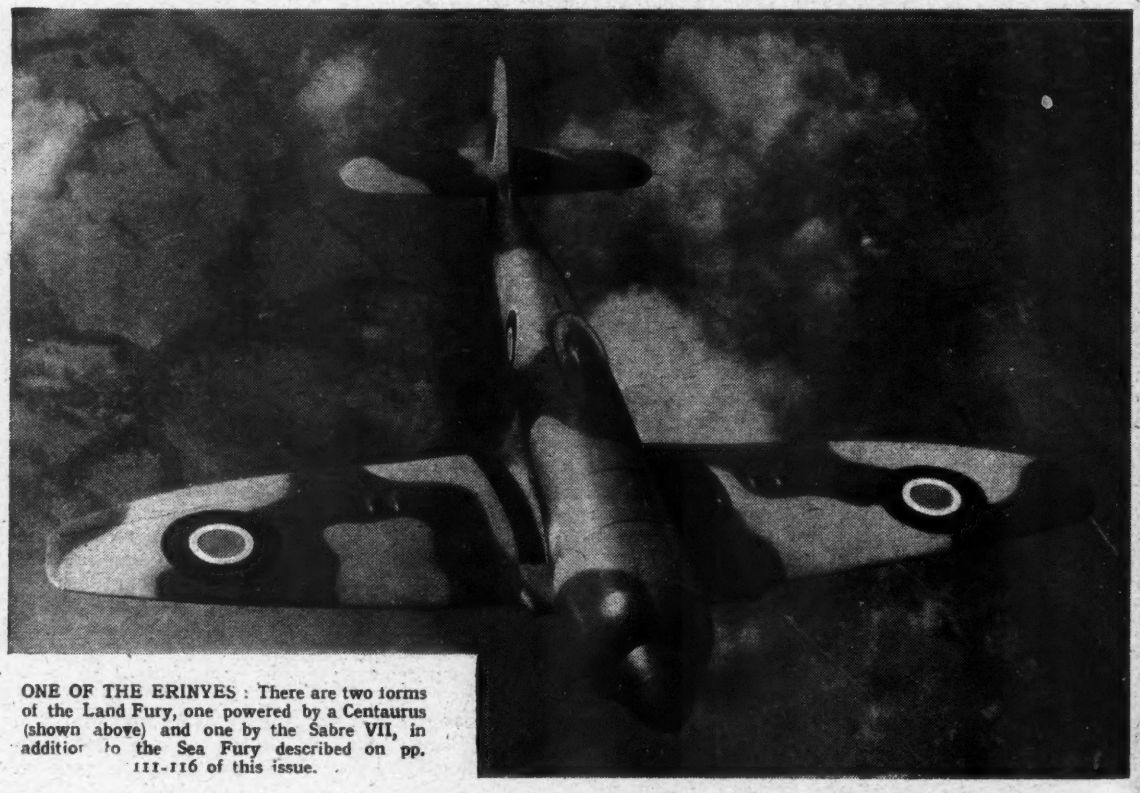
Internal and European services will be run initially by B.O.A.C., two of whose members, Sir Harold Hartley and Mr. d'Erlanger, have been given the special duties of organising British European Airways, of which they will, when the corporation is established, become chairman and chief executive respectively. They will then, presumably, be replaced on B.O.A.C.'s board by others. Again we have a surface-transport expert (in this case railways) and man with air experience as chairman and chief executive respectively.

On B.O.A.C. itself the new blood on the board does not appear to belong exclusively to any of the recognised "groups." Major Thornton certainly has experience of both shipping and flying, and is thus undoubtedly a valuable addition. Mr. Garro-Jones, when he was an M.P., took a keen, though not always very well-informed, interest in air matters. Altogether it can probably be said that, so far as can be judged at present, the new appointments are fairly sensible. We hope that, when all three boards are fully constituted, they will show a rather greater preponderance of men with practical transport flying experience than does the present B.O.A.C. board.

The announcement made by Mr. Ivor Thomas about the frequencies of services to Europe, and more particularly his promise that these services will be started in February, must be welcomed.

CONTENTS

The Outlook	103
Westland Cabin Atmosphere Control	105
Here and There	108
Civil Aviation Plans	110
Hawker Sea Fury X	111
A Spitfire Score—Part II	a
Halton School	118
Safer Flying	120
Civil Aviation News	121
Coastal Command's Own War	123
Correspondence	125
Service Aviation	126



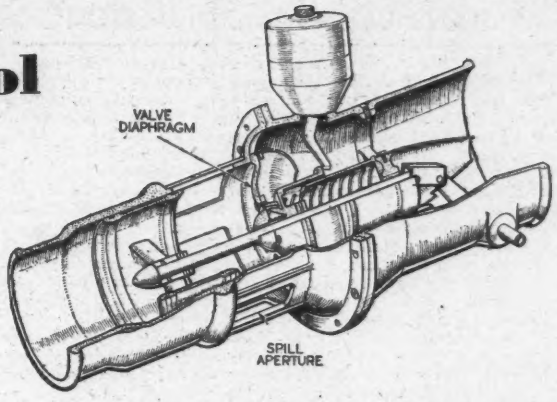
ONE OF THE ERINYES : There are two forms of the Land Fury, one powered by a Centaurus (shown above) and one by the Sabre VII, in addition to the Sea Fury described on pp. 111-116 of this issue.

Westland Cabin Atmosphere Control

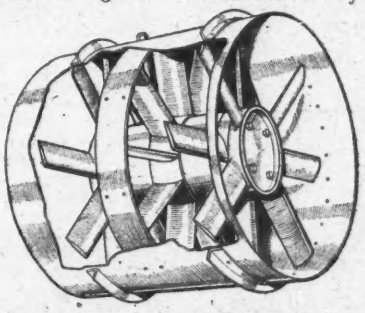
Review of Components and Installations for Typical Cabin Interior Conditioning Scheme

TO the potential ordinary passenger of the modern airliner there is something psychologically forbidding about the idea of pressurising. It seems to connote inflation, and the idea of being blown up is naturally somewhat repulsive. It is, therefore, desirable that the term "pressurising" be relegated purely to the technical field for specific use—and that we should, instead, adopt the term "atmosphere control": after all, the latter is both more descriptive and more accurate for, although pressurisation *per se* is only part of the general aspirative problem, the term has come to be used as an overall title for the whole field.

Westland Aircraft, Ltd., have specialised in cabin atmosphere control for some time and have amassed a greater fund of data on the subject than probably any other commercial concern. They have an M.A.P. contract to act as consultants on comfort and safety provisions as well as on the operational side of cabin atmosphere control and, in fact, are consulted by most British firms interested in this branch of aeronautical design. The laboratories at Yeovil are fairly extensive and in their comprehensive range of test equipment include a decompression tank sufficiently large to take a 12ft. dia. fuselage test section. Almost total evacuation can be attained, also refrigeration to somewhere in the region of −65 deg. F. Humidifying and drying equipment is also available and, at a later date, means of artificial excitation of the test fuselage will be embodied to show the effects of vibration on the aspirative problem in order more accurately to simulate actual dynamic flight conditions.



Non-return and spill valve, showing masking sleeve and valve diaphragm with control linkage.

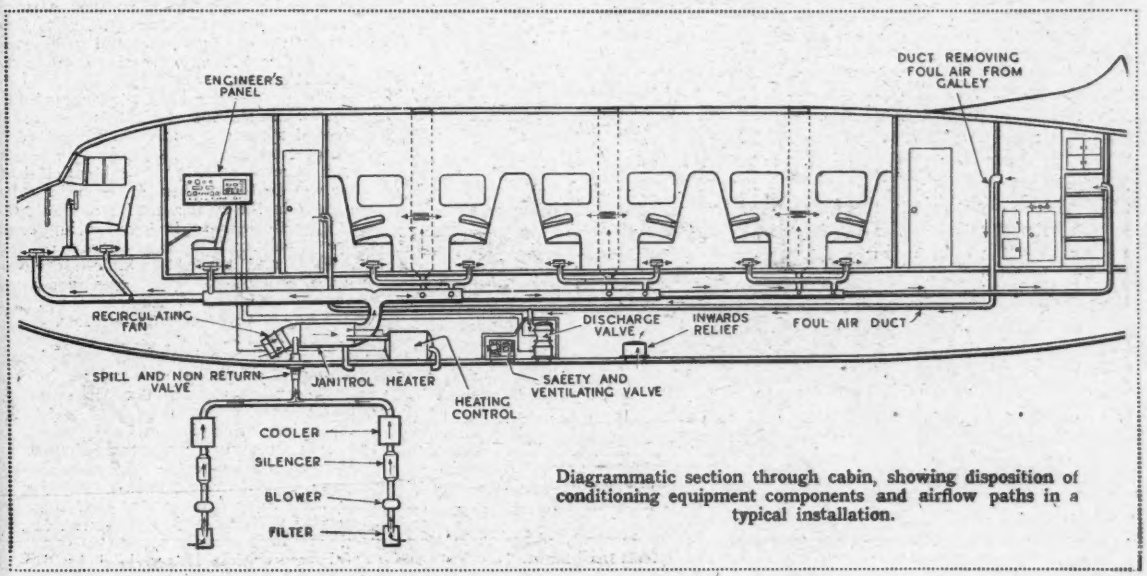


Recirculating fan, with two banks of blades and central rectifying vanes.

Perhaps the best way of giving a general overall picture and reasonable appreciation of the problem would be to deal with a typical system as installed, say, in a high-speed luxury passenger aircraft designed to operate at 25,000ft., which altitude by general consensus of opinion, appears to be the average optimum economic height for the new British aircraft coming along.

This figure of 25,000ft. has been agreed upon in connection with a differential pressure of 5½ lb./sq. in. to give a cabin interior pressure equivalent to atmospheric at 8,000ft. However, this can be regarded as something of an interim measure as it would patently be better to maintain ground level conditions in the cabin irrespective of the height at which the aircraft flies.

It has been held by some that the application of pressure should be delayed until the aircraft reaches 8,000ft. and, as additional height is gained, the 8,000ft. pressure should be maintained in the cabin. One of the main drawbacks to this scheme is that the aircraft must not be allowed to gain or lose height too quickly below 8,000ft., as discomfort is caused to sitting passengers at rates of descent in excess of 250 ft./min., whilst for



Diagrammatic section through cabin, showing disposition of conditioning equipment components and airflow paths in a typical installation.

WESTLAND CABIN ATMOSPHERE CONTROL

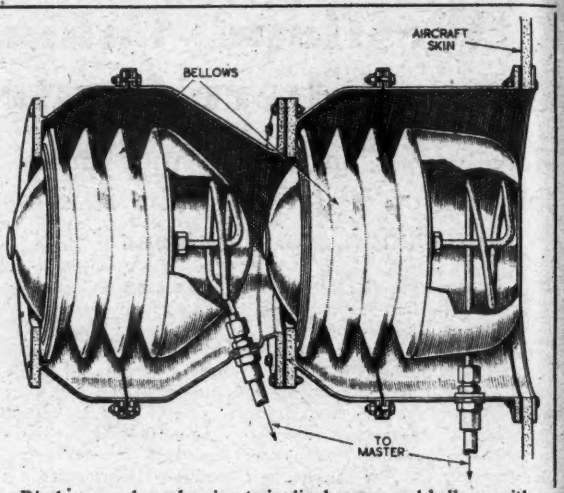
sleeping passengers the figure comes down to 150 ft./min. For this reason it is apparent that the aspirative equipment should be such as to permit cabin pressure to be held constant at ground level conditions, or delayed until a desired height is reached. As the pressure differential is limited to 5½ lb./sq. in. it is obviously impossible to maintain ground level conditions above approximately 12,500ft.; above this altitude the cabin pressure will fall progressively until it is equivalent to 8,000ft. when the aircraft is at 25,000ft.

In a typical installation such as we are considering, it will be seen from the illustrations that an internal circulatory system is employed to maintain a requisite flow of air through the cabin, foul air being discharged overboard and a proportion of partially vitiated clean air being recirculated.

Air is entrained through intakes in the leading edges of the wings and passes through air cleaners before entering the blowers, which are usually engine-driven components mounted in the inboard nacelles. From the blowers the air travels through silencers, thence to coolers, through second silencers, and so to a non-return and spill valve mounted in the fuselage skin. Having passed through the N.R. and S. valve into the fuselage interior, the air is ducted to the downstream side of a recirculating fan from which, in common with recirculated air, it is passed to a heater. On leaving the heater the feed is through either a refrigerator or humidifier—according to whether the external atmosphere is hot and wet, or cold and dry—and, in this connection, a rather interesting table has been compiled under the ægis of the Royal Aircraft Establishment as being rather more representative in accurate definition of Sub-Arctic and Tropical Summer conditions than the I.C.A.N. standard for these conditions.

Altitude ft.	Temp. °F.	Relative Density	Air Cu.ft./lb.	Moisture Grains/lb. air
Sub-Arctic Winter				
0	— 4	1.138	11.50	4.53
5,000	2.5	0.934	14.00	7.68
10,000	—11	0.796	16.45	4.16
15,000	—29	0.680	19.30	1.90
20,000	—45	0.575	22.80	0.87
25,000	—60	0.482	27.20	0.39
Tropical Summer				
0	105.8	0.917	14.3	354.0
5,000	88.0	0.788	16.6	231.0
10,000	70.0	0.674	19.2	150.5
15,000	52.3	0.571	23.0	102.0
20,000	34.0	0.482	27.2	62.6
25,000	17.0	0.404	32.4	38.5

It will be noticed that the Sub-Arctic winter 5,000ft. condition has a temperature inversion as against the sea level and 10,000ft. values. It is thought that this is caused by the relative absorption of sun heat as between air and land masses,



Discharge valve, showing twin diaphragms and bellows with connections to master unit.

the latter not absorbing so much and, therefore, not giving up so much, with the result that, below 5,000ft., the ambient temperature will be lower (due to the ground temperature) than that at the 5,000ft. level.

After having been "conditioned" the air is distributed through ducts to the cabin interior, crew quarters, etc., being led to vents beneath the seats and grilles set fairly low in the walls. Vitiated air is extracted through vents in the top curvature of the roof, and is ducted down inside the cabin walls to the under-floor space where it is entrained by the recirculating fan. From toilet rooms, galley, or, in fact, anywhere where air can be contaminated, sealed ducts lead direct to a discharge valve; consequently the airflow is always *from* the cabin *into* the toilets, galley, etc., and so there is no possibility of foul air entering the cabin. It is thus patent that the direct loss of foul air through the discharge valve is constant, and this is balanced by the constant supply of fresh air, the ratio being approximately two-thirds recirculated to one-third fresh.

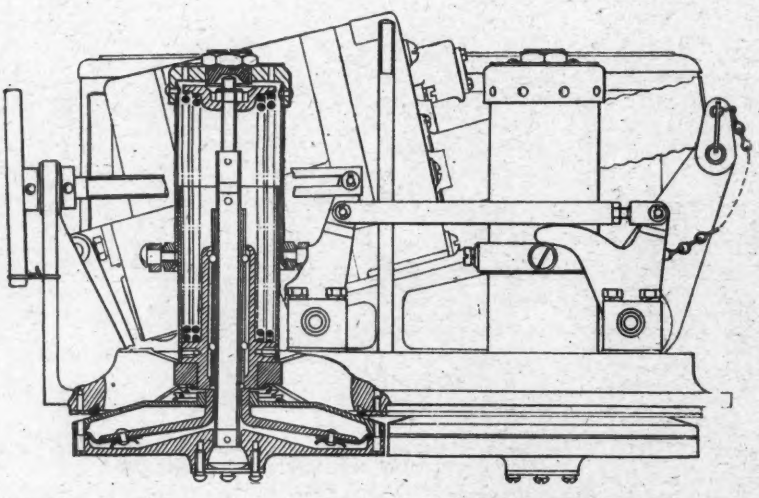
Rate of Air Change

Cabin air change is rated at 1 lb./person/minute, as an average, and the generally accepted cabin temperature is 65 deg. F. with about 50 per cent. relative humidity, these giving the median pleasant conditions for travel; they can, however, be changed within limits as may be necessary. For example, when flying from a temperate to a tropical climate, both temperature and relative humidity could gradually be increased during flight, so that passengers were given a chance to acclimatise themselves during transit and so obviate the unpleasant physical shock effect of rapid climatic change.

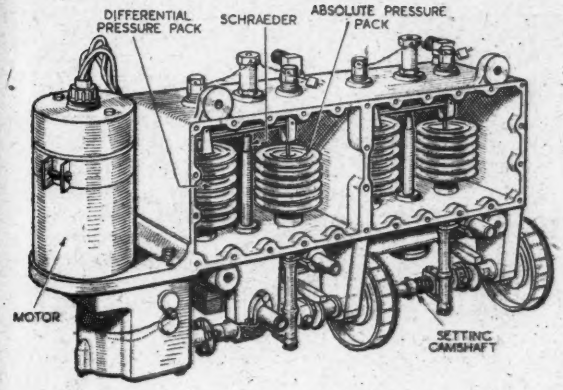
Having described the sequence of airflow through the various units in a typical system, we might now with advantage examine the several components individually, and, for the sake of clarity, we will deal with them in the order they appear in the system we have described.

The air intakes in the leading edge are fitted in the under-surface of the nosing, and the apertures are divided by lateral louvres which engender a reversal of airflow to occasion a velocity separation of solid particles in the air stream by means of centrifugal force: this provides an initial cleansing action which is amplified and carried to an advanced degree by the air cleaners. These are Vokes tray-type *Aero-Vee* filters; the principle of which is that, by providing a very large area of filtering element relative to the intake and outlet areas, the velocity through the filter is reduced to such an extent that the suspended particles of foreign matter in the air stream are easily arrested.

Pressurisation is provided by Roots



Safety valve unit, with one valve sectioned. The motor and linkage is to open the valves for ground ventilation or unpressurised flight.



Master control unit, showing capsule packs, valving beams and setting controls.

type Marshall blowers, a detailed description of which appeared in the June 14th, 1945, issue of *Flight*. Suffice here to say that these blowers are extremely efficient units of the internally cooled solid-displacement type, capable of handling up to 80 lb. air/minute.

Unfortunately, air can carry sound waves, so some means have to be provided for neutralising the noise imparted by the blowers; for this reason Burgess silencers are incorporated in the system. These consist of cylinders housing four radially disposed axial-tubes which are perforated and are surrounded by cellular wadding to cut off the peak amplitudes of the troublesome frequencies.

Cooling the Air

Marston-Excelsior air-to-air coolers of the corrugated sandwich-cell type are fitted next to the silencers to reduce the temperature imparted to the air by passage through the blowers.

The Westland Non-Return and Spill valve, which is fitted in the fuselage skin, consists of a sleeve mask for escape ports in the "entry" end, and a diaphragm non-return face at the cabin wall, the diaphragm lifting according to the differential pressure across it and the degree of lift being transmitted by a standard Desynn system—an indicator on the engineer's panel. The masking sleeve to the "spill" ports is actuated by a reversible electric motor controlled from the engineer's panel to cover or open the spillage ports as required.

The Heater is a Janitrol surface-combustion type of a capacity to suit the particular requirements; the 50,000 B.T.U. model consumes 3.6 lb./hr. of fuel, which is fed from the engine side of the main fuel pumps.

The Re-circulating Fan embodies a 0.6 h.p. D.C. motor axially mounted in a 12in. dia. duct and driving two banks of four-blade wooden fans between which are light-alloy rectifying vanes. The fan is scarcely a two-stage unit as there is no difference in pitch as between one bank and the other; the purpose of the unit is to provide sufficient pressure to overcome back-pressure in the ducts, etc., but not necessarily to give an increase in flow.

Tandem Discharge Valve

The Discharge Valve, a Westland component, is a tandem valve unit, each half of which is capable of handling the total work. In essence it consists of a non-return diaphragm face backed by a flexible rubber bellows, the interior of which is subject to air pressure from the master control unit. Upstream of the first diaphragm is cabin pressure and downstream (outside the bellows) of the second diaphragm, is atmospheric pressure. Each valve diaphragm is kept closed by the differential pressure across it occasioned by the larger area on the bellows side as against the smaller area enclosed by the peripheral seat on the cabin side. The interiors of the bellows are subject to air pressure from the master unit and accordingly the valves are kept closed or lifted respectively to maintain or reduce cabin pressure. Thus it may be appreciated that the degree of spillage or exhausion of air from the cabin is dependent upon the cabin interior pressure.

The brains of the conditioning system can be said to be resident in the Westland Master Control Unit which works interdependently in conjunction with the discharge valve. Briefly, it consists of two sets (one for each valve and bellows in the discharge unit) of capsule packs, one set being subject to the differential of cabin pressure and external atmospheric pressure, and the other set subject to cabin pressure and absolute vacuum. Each capsule pack bears on a beam linkage which controls the opening and shutting of a Schraeder valve connected to external atmosphere, and each pair of packs is housed in a separate compartment subject to 80 per cent. of cabin pressure through a permanent bleed of lower capacity than the Schraeder.

Thus it is that the inter-related movement of the capsule packs controls the motion of the beam and consequently the aperture of the Schraeder bleed to atmosphere. A feed line leads from the interior of each discharge valve bellows to the interior of each capsule compartment, and consequently the degree of discharge from the cabin through the valves is governed by the differential across the valves, as determined by the master unit integrating cabin pressure differential against external atmosphere.

Automatic Pressure Control

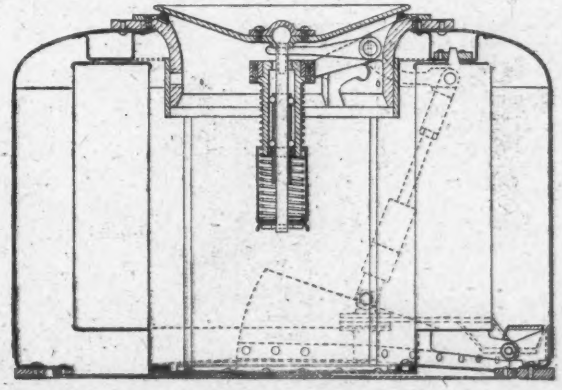
When the Schraeder is fully open there is no pressurisation of the cabin, but when it is almost closed and the flow through it is less than the flow through the bleed from cabin into capsule compartment, then pressurising starts because the compartment/bellows pressure is the same as that of the cabin, and, owing to the greater area on the bellows side of the diaphragm, the valve tends to close and cabin pressure does not decrease further. This normally occurs at 8,000ft., although it can be otherwise if the valve is correspondingly set to start pressurising at a different altitude.

The Westland Inward Relief valve is fitted in the cabin skin with hinged doors which actually form part of the skin area. The valve element of the unit is a lightly spring-loaded diaphragm which lifts for inward relief of pressure—for example, when the aircraft descends rapidly without pressurisation, or, in fact, where a reverse differential exists. The doors are so arranged that one can be partially opened to act as a scoop, and a mechanical linkage at the same time lifts the valve, the air enducted so entering the fuselage. Two small flap valves are fitted in the doors to admit atmospheric pressure and so permit the valve automatically to lift when a reversal of differential pressure occurs. The scoop is lowered by an electric motor on the unit remotely controlled by the flight engineer, and by this means, if required, cabin ventilation is possible without pressurising when flying at low altitudes.

Ground Conditioning

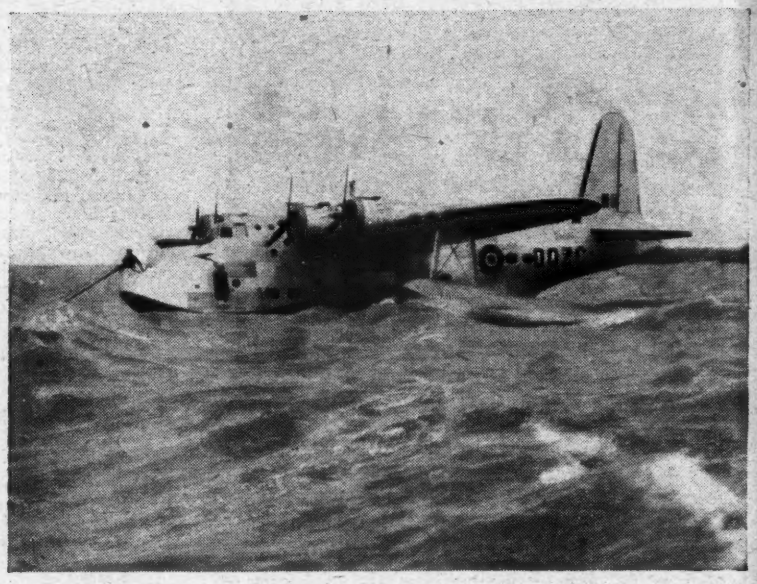
Complete full-scale equipment carried in mobile trucks permits ground conditioning of the aircraft in intemperate climates. For this operation both doors of the inward relief valve can be fully opened, and the trunk pipe from the ground conditioning truck can then be attached by a bayonet connection beneath the valve

The final component in the list of equipment is the Westland Safety valve, which comprises duplicated valve elements each capable individually of coping with the total work. The valves are ordinarily set to some value above the normal differential—for example, with 5½ lb./sq. in. differential they are set to relieve at 6.2 lb./sq. in. and to shut again at 5.7 lb./sq. in. Each valve element incorporates a compensating device embodied in the valve head to ensure that the valve is positively open or positively closed—there is no weep. A remotely controlled electric motor on the unit actuates a screw jack which in turn operates a simple transmission to open the valve wide for ground ventilation or unpressurised flight.



Inward relief valve fitted in cabin skin for relief of internal pressure drop and ground conditioning.

HERE AND THERE



SEAWORTHY SUNDERLANDS: This picture of a B.O.A.C. Sunderland, taken just before leaving Poole for Karachi with 18 passengers, shows the kind of seas recently experienced even in the harbour's sheltered waters.

Special Flight

THE B.S.A.A. Lancastrian, *Star Light*, left Heathrow last week-end for Rio de Janeiro carrying Admiral Sir James Somerville, Capt. Surgeon A. W. Laybourne (his secretary), Lt. K. R. H. King, R.N. (his equerry), Maj. Gen. Beaumont-Nesbitt, and Mr. Pleydell-Bouverie, to represent the British Government at the inauguration of the new Brazilian Government.

Coastal's "Kills"

AIR CHIEF MARSHAL SIR PHILLIP JOUBERT disclosed the official figures for U-boats destroyed and damaged by Coastal Command aircraft when he attended the Command's recent officers' reunion dinner.

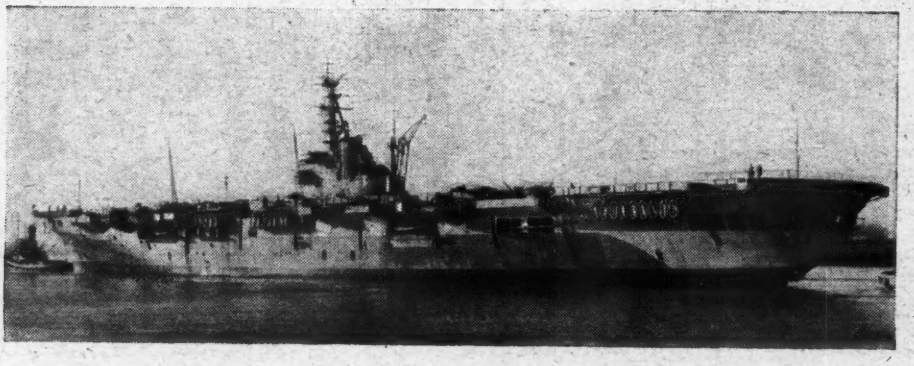
Sir Phillip, a former A.O.C.-in-C. of Coastal Command, said that during the entire war the Command "killed" more than 200 submarines and damaged approximately another 280. The peak periods were during 1943, when more than 80 U-boats were sunk and during the D-Day operations.

Canuks Borrow a Carrier

THE 18,000 ton aircraft carrier, *Warrior*, built for the Admiralty by Harland and Wolff at Belfast and commissioned last week, is being loaned to the Royal Canadian Navy. The ceremony was attended by Earl Granville, Governor of Northern Ireland, and the High Commissioner for Canada, Mr. Massey.

The *Warrior* carries 30 aircraft—Fireflies and Seafires—and her armament, entirely anti-aircraft, includes Bofors and 4-barrelled 2-pounder pom-poms. She has a complement of 140 officers and 1,100 ratings, and is commanded by Capt. Frank Houghton who has been in London as head of the Canadian Naval Overseas Mission for the past two years.

Entertainment for the crew has been well catered for by the provision of a 15-piece band, a cinema, an ice-cream bar, and a library of 2,000 volumes. There is also a hospital with 16 beds and an operating theatre.



The carrier H.M.S. *Warrior*, just commissioned for the Royal Canadian Navy (see adjoining text).

Appeal from Brooklands

FROM Captain H. Duncan Davis comes an appeal for help. Among his many activities he is chairman of the local A.T.C. squadron, which is one of the original founder squadrons, and one of the few which has its own permanent headquarters, with lecture rooms, workshops, drill hall and offices.

Most of the members of the committee are London business men who are now hard at work trying to get their concerns organised on a peacetime basis; consequently, they find it difficult to spare as much time as previously to the affairs of the squadron.

Duncan Davis would be grateful if three conscientious people would volunteer to look after the squadron's sports, its social activities, and to help fill in the numerous forms still demanded by the Air Ministry. A letter to Duncan Davis at Brooklands Aviation, Ltd., Brooklands, Weybridge, Surrey, or a 'phone call to Byfleet 236, will meet with a hearty response.

Visit of Dutch Scientists

A SCIENTIFIC party from the Delft Technical University are at present visiting this country to study wartime developments and future trends. During the last six years aeronautical experts in Holland and other occupied countries have had little chance of keeping abreast of the very rapid technical developments in aviation in allied countries.

Mr. J. Van Burren, W.I., who is supervisor of the aeronautical branch of the University, and was until the war associated with the Koolhoven company, hopes during his stay here to visit many of our principal aircraft and aircraft engine manufacturers.

The party is making its headquarters at the Society for Visiting Scientists, 5, Old Burlington Street, London, W.1.

Napier Plans

THE former shadow factory at Liverpool operated during the war by D. Napier and Son, Ltd., which was recently allotted to Napiers and their parent firm, the English Electrical Co., Ltd., by the Board of Trade for peacetime production, is now being divided roughly into two parts, a process which entails clearing a large portion of this 80-acre plant for the use of the E.E.C. in the manufacture of light electrical equipment.

Some 80 per cent. of the Sabre engine output came from this northern factory during the war, and Napiers have decided to concentrate their future engine production here, leaving the Acton plant free for experimental and development work in aircraft engines.

In spite of the handicap

HERE AND THERE

disturbance caused by rearranging the layout, some 3,000 workers are still engaged on fulfilling current contracts, and it is expected that when post-war production gets properly into its stride, up to 4,000 will be engaged on regular aircraft engine production.

Incidentally, the Napier standards room here (where an accuracy of 1/1,000,000in. is obtainable) is being made available to other engineering firms in the area.

Back in Circulation

THE first post-war issue of the *Handley Page Bulletin*, which was forced to suspend publication on the outbreak of war, has made its appearance.

January's issue of the *Bulletin*, attractively produced and printed in English, French and Spanish, is devoted to a description of the Hermes and includes some excellent colour illustrations of the interior.

A future number of the *Bulletin* will feature the Hastings, military version of the Hermes, which is now in production for the R.A.F.

U.S. HONOUR: Mr. John G. Winant, American Ambassador, presents his country's Distinguished Service Medal to Marshal of the R.A.F., Lord Portal of Hungerford, at a recent investiture held at the U.S. Embassy in London.

News in Brief

R.A.F. TRANSPORT COMMAND beat Maintenance Command by 13 points to 11 in the recent Inter-Command Boxing Championship Final at Uxbridge.

* * *

Sweden is developing a new jet-propelled aircraft, according to a recent statement by Stockholm radio quoted by *Reuter*, and will also have a new type of 24-seater airliner ready in the summer.

* * *

Fifteen Dakotas have been bought by the Dutch Government in order to lighten the task of the Dutch Navy Squadron now stationed in Java.

* * *

It is proposed to hold a reunion dinner in London, during April next, of ex-members of 170 Mustang Squadron, R.A.F., and those who would like to attend should communicate with Major B. J. W. Hill, Eton College, Windsor.

* * *

An attempt is being made to revive the Old Ismailians' Association, and any who have served at the H.P. W/T. Ismailia are invited to communicate with Sqn. Ldr. C. A. Martin, 20, Wimbledon Park Road, Southsea, Hants.

* * *

Brig. Gen. C. V. Haynes, U.S.A.A.F., who had a distinguished record of air service with Maj. Gen. Claire Chennault's famous "Flying Tigers" in China, has been appointed Commanding General at the Newfoundland U.S. Base at Fort Pepperrel, near St. Johns.

* * *

Every former member of aircrew in the R.A.F. may now apply for his flying log-book for personal retention, and similarly the legal personal representative or established beneficiary of an officer or airman who has lost his life may apply for the dead man's log-book. Such requests will normally be granted, but some log-books have been lost or destroyed by enemy action.

* * *

Dr. S. G. Hooker, B.Sc., D.I.C., Assistant Chief Engineer of the Rolls-Royce turbo-jet and turbine airscrew division, delivered last Monday the second of his lectures on High-Speed Flight before the Royal Society of Arts. The third and last of these, his Cantor Series lectures, will be given on February 4th, at 1.45 p.m.

* * *

Air Cdre. F. M. F. West, V.C., is resigning his post as head of the Directorate of Foreign Liaison at the Air Ministry and is retiring from the R.A.F. He has been appointed assistant managing director of the Eagle-Lion film distributors by Mr. J. Arthur Rank. Air Cdre. West won his V.C. on Armistice Day, 1918, in an air fight which cost him a leg, and has been Air Attaché in Finland and other Baltic countries, and in Italy and Switzerland.

* * *

Group Capt. John Cunningham, D.S.O., D.F.C., one of the outstanding night-fighter pilots of the war, has joined the de Havilland Engine Co., Ltd., as chief test pilot, and his duties will include demonstration flying. He was trained in the D.H. Technical School and in the principal departments of the company, and joined the Auxiliary Air Force some time before the outbreak of war.

* * *

Expanding business and a desire to give better local service has caused David Brown and Sons (Huddersfield), Ltd., to open an office at 71 and 72, Atlantic Chambers, 7, Brazennose Street, Manchester, 2. (Tel.: Blackfriars 0011.)

* * *

Aircooled Motors Corporation, Syracuse, N.Y., makers of the Franklin aircraft engine, has been purchased outright by the Republic Aviation Corporation, for $1,500,000. The report says improved production methods and new tooling will be introduced to increase the output of Franklin engines.

* * *

Mr. Charles B. Baker, who has been with the Fairey Aviation Co., Ltd., for many years, has resigned for purely private reasons and intends shortly to go to New Zealand. Mrs. Marya Greenlees has been appointed to the publicity section of the sales development manager's office.

* * *

The Asiatic Petroleum Co., Ltd., has changed its name to The Shell Petroleum Co., Ltd.

WAR WASTE: These tumbled remains of U.S. aircraft collected on Guam Island are eloquent of war's extravagance. The "casualties" range from trainers to Superfortresses.

Civil Aviation Plans

The Government's Development Arrangements in Detail : Dealing with the Present Aircraft Shortage

A THREE-PHASE development in the production of British civil aircraft to cover the transition from "converted bombers" to Brabazon types powered by jets or by gas turbines driving airscrews, is part of the Government's policy for civil aviation. The use of Valley, in Anglesey, as a bad-weather alternative to Heathrow, and the early operation of B.O.A.C. scheduled services from Northolt were other outstanding points made by Mr. Ivor Thomas, Parliamentary Secretary to the Ministry of Civil Aviation, when he introduced the plan for civil aviation in the House of Commons on January 24th.

The organisation of the three corporations which are to run British civil aviation and the composition of their boards is outlined elsewhere in this issue. Mr. Thomas, in his introduction, said that the corporations would not overlap one another in their operations; consequently there would be no competition —only, he hoped, a healthy rivalry. Although there were to be three corporations, it was intended to centralise such services as lent themselves to centralisation so as to avoid the triplication of common functions.

Passing on to the question of State ownership of airfields, Mr. Thomas considered that, because the State provided meteorological, radio, and control services, it was a natural development that the State should own the airfields. The development of the internal airfield system would, for many years, require close co-operation with Service needs, and with the interests of the Ministries of Town and Country Planning, War Transport, Agriculture, and other departments. Consequently, over-all planning fell into the sphere of public administration. Further, the costs of building and maintaining transport airfields were heavy, and the revenue from landing charges at reasonable rates would not cover the outgoings.

	In use now or shortly.	On order or being converted.
First Stage (Present)		
Avro Lancastrian ...	27	12
H.P. Halifax C-VIII ...	—	14
Short Sunderland ...	24	12
" C-Class ...	13	—
" G-Class	1	—
Dakota	56	16
Liberator	12	—
Boeing 314	3	—
Ju-52	25	—
Constellation	—	5 (47-strs.)
	161	59 = 220
Second Stage (Intermediate)		
Avro York	25	12
" Tudor I	—	20 (12-slprs.)
" Tudor II	—	79 (22-slprs and 36/44-strs.)
Vickers Viking	—	108 (21-strs.)
Short Solent	—	Unknown
	25	219 = 224
Third Stage (Future)		
Bristol Wayfarer ...	—	13
" Freighter ...	—	12
D. H. Dove, Airspeed AS-57, Bristol 167, and other Brabazon types powered by jets or airscrew-turbines		Unknown

He insisted that the State-ownership of airfields did not mean that they would be "run from Whitehall." A regional organisation was planned.

Prestwick, as well as Heathrow, would be designated permanently as an international airport, and would be open to aircraft of all nations. Until Heathrow was complete, Hurn would continue to be used. Several bad weather alternatives to Heathrow would be necessary—among them, Valley, a wartime Service airfield with a good weather record—and an airfield would be provided in Northern Ireland suitable for direct flights to the Continent. As Croydon was not good enough for large aircraft, Mr. Thomas said that Northolt would, in the immediate future, be used mainly for civil flying, and foreign airlines would be admitted on a reciprocal basis. As B.O.A.C. took over European services, they would be operated from Northolt, but, for the time being, internal airlines would continue to be run from Croydon. Information given by the Parliamentary Secretary on the likely frequency of various services is shown in an accompanying table.

Future Aircraft

When he discussed the types of aircraft to be used, the Parliamentary Secretary agreed that we were suffering now, and should suffer for some years to come, from the inevitable neglect of civil aviation during the war. The wartime concentration on combat aircraft meant now that there would have to be three stages in the production of civil aircraft. In the first, we should have to rely on the conversion of bombers; in the second, we should be using civil developments of types originally used as military aircraft; but, in the third stage, there would be a complete breakaway from previous designs, and aircraft specifically designed from the outset for civil use would come into operation.

These three stages, and the numbers of aircraft to be used—so far as they were disclosed—are shown in another accompanying table, but it must be appreciated that the "stages" overlap.

Mr. Thomas made the astounding announcement that Ju 52s would be used on internal routes until suitable British machines were available. He also said that five Constellations would be bought from America to enable B.O.A.C. to operate a daily service across the Atlantic, beginning, probably, in July. B.O.A.C.'s Dakotas, which were supplied under lend-lease, had now been purchased without restriction on their use and would be used on European and other medium-range services.

Incidentally, on the following day, Mr. Thomas made a further statement in the House, in which he disclosed that research was being undertaken into the use of gas turbines for flying boats, and that Lord Winster believed there was a great future in civil aviation for the flying boat.

Full consideration would be given to the future of flying boats generally, and the scheme for the construction of a marine air terminal at Langstone Harbour, near Portsmouth, was being reconsidered.

NEW SERVICE FREQUENCIES.

Northolt—Paris ...	...	21 per week each way.		
" Brussels	...	14	"	"
" Amsterdam or Hague	...	7	"	"
" Copenhagen	...	7	"	"
" Oslo ...	...	3	"	"
U.K.—South Africa (Yorks)		6	"	"
U.K.—India (Yorks.)	...	7	"	"

When Mr. Thomas dealt with the financial aspects of the civil aviation plan, he made the point that the "V.I.P. mentality" had been the greatest curse of British civil aviation. He said that the present Government intended to cater for mass travel by air. An advisory body would be set up, to which the public could make representations on fares, adequacy of services, co-ordination of timetables and so on. Fares on internal routes would invite comparison with road and rail: The Government hoped that fares on other routes would be settled by international agreement.

There would be fair payment for all physical assets taken over by the State, and, in particular, for airfields, whether municipally or privately owned. The Government considered that no one had a vested interest in the air, and therefore saw no justification for paying compensation to private operators for goodwill or development expenses.

So far as flying activities, other than regular scheduled services, were concerned, it was not proposed to exclude private operators from charter work, but he made it clear that an air taxi *must* be a taxi and not a pirate bus, and that no attempt to run regular services under the guise of charter work would be tolerated. No restrictions would be placed in the way of private flying other than those necessary in the interests of safety. In order to encourage club flying, it had been decided to make available to clubs, at low prices, about a hundred light aircraft.

One interesting point made by Mr. Thomas, which should give cause for satisfaction, is that he agreed that civil servants were not the best men to run airline corporations, and that these corporations would be more comparable, in their staffing arrangements, with normal business than with the Civil Service. However, during the debate which followed, there was more than one comment on the marked preponderance of railway and shipping interests on the boards.

Replying to the debate, and answering this criticism, Mr. Herbert Morrison suggested that a sufficient number of high-powered business executives, administrators, and organisers had not yet been evolved for civil aviation; and hence, that the members of the boards had been chosen primarily on their merits for business and excutive capacity. Unfortunately, during the greater part of Mr. Morrison's speech, the subject of civil aviation tended to become completely lost in one of his now all-too-frequent political extravaganzas.

DRAGON RAPIDE

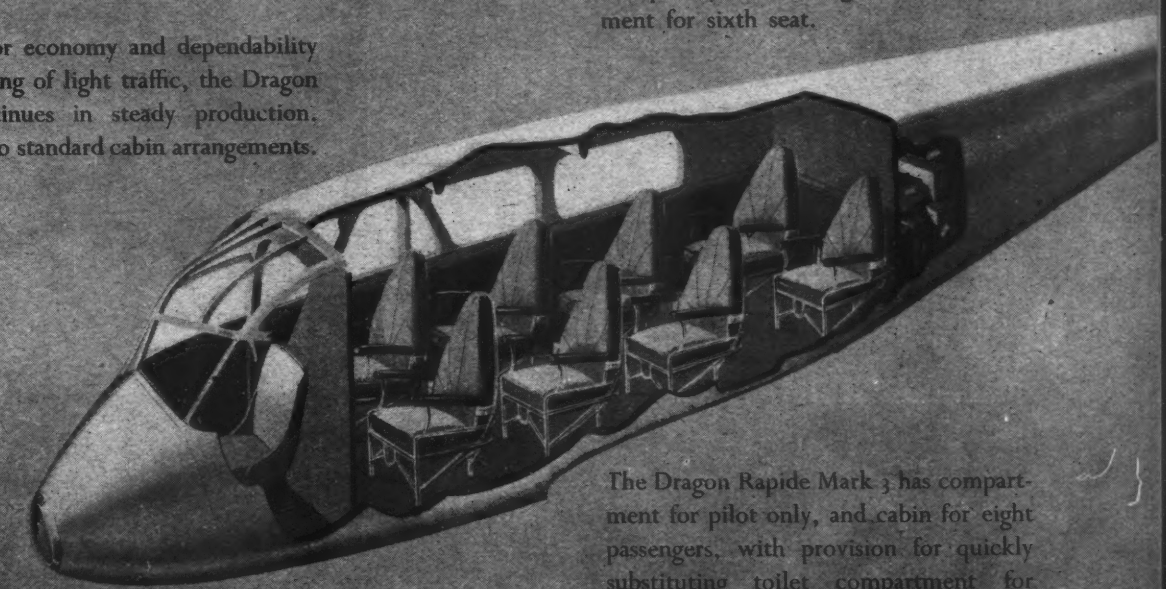
Early Delivery

£5,500

Completely furnished with provision for radio

The Dragon Rapide Mark 2 has compartment for pilot and radio operator, and cabin for six passengers, with provision for quickly substituting toilet compartment for sixth seat.

Unrivalled for economy and dependability in the handling of light traffic, the Dragon Rapide continues in steady production. There are two standard cabin arrangements.



The Dragon Rapide Mark 3 has compartment for pilot only, and cabin for eight passengers, with provision for quickly substituting toilet compartment for eighth seat.

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SEA FURY X

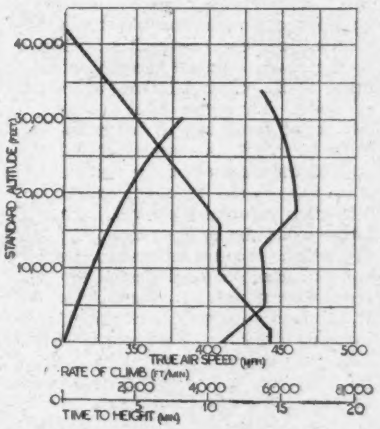
Latest Single-seat Hawker Fighter : Ingenious Hydraulic Wing Folding : Outstanding Rate of Climb

IT is, perhaps, something of a good omen that in releasing details of the Hawker Sea Fury X it can be accepted that the Fleet Air Arm is finally getting a deserved priority of types, for this high-performance single-seater Fleet fighter is more advanced than its R.A.F. counterparts. The plural is used intentionally since there are two versions of the "land" Fury, one powered with a Bristol Centaurus XV and the other—the Fury I—powered with a Napier Sabre VII, both aircraft being types distinct from the Sea Fury, which employs a Centaurus XVIII to drive its Rotol five-blade metal airscrew. Aside from individuality in power unit, the major difference of the Sea Fury as compared with the two "land" Furies lies in the provision of folding wings and an arrester hook; other than this the three aircraft are pretty well alike.

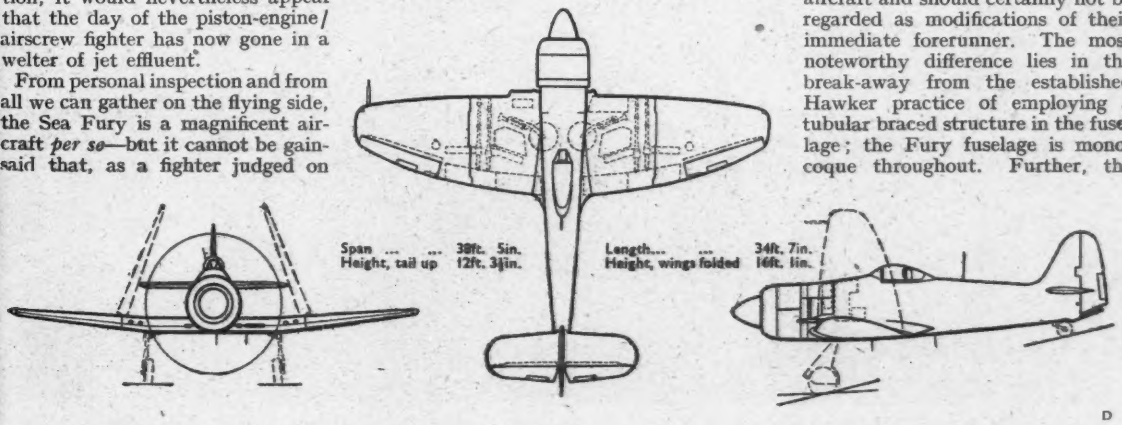
We do not wish in any way to detract from the quality of the Fury, but it is difficult not to regard it as something of a wasted effort, for although there are, no doubt, many aspects of the problem worthy of considerable attention, it would nevertheless appear that the day of the piston-engine/airscrew fighter has now gone in a welter of jet effluent.

From personal inspection and from all we can gather on the flying side, the Sea Fury is a magnificent aircraft *per se*—but it cannot be gainsaid that, as a fighter judged on present standards, it is eclipsed on every count except that of range by jet types. However, it is probably a good thing that fighter pilots, both of the R.A.F. and F.A.A., should in future be given the opportunity of flying a high-quality "orthodox" machine such as the Fury as a supplement to their experience on jet-propelled fighters.

These curves of climb, time to height and level speeds show the Sea Fury's quality.



Although the Furies bear a very distinct resemblance to their forerunner, the Tempest, they are all entirely new aircraft and should certainly not be regarded as modifications of their immediate forerunner. The most noteworthy difference lies in the break-away from the established Hawker practice of employing a tubular braced structure in the fuselage; the Fury fuselage is monocoque throughout. Further, the



D

SEA FURY X

Monocoque Fuselage : High-speed Section Wing : Leading-edge Intakes

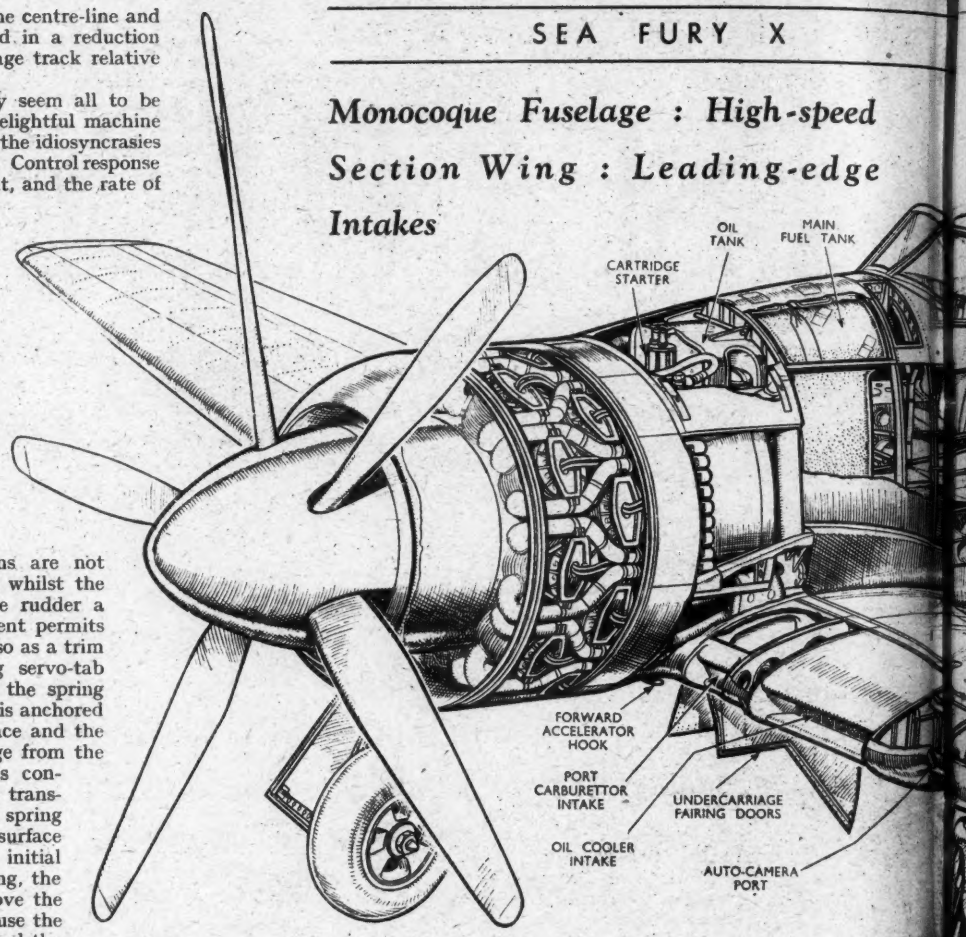
wings are now joined on the centre-line and this alteration has resulted in a reduction of span and of undercarriage track relative to the Tempest.

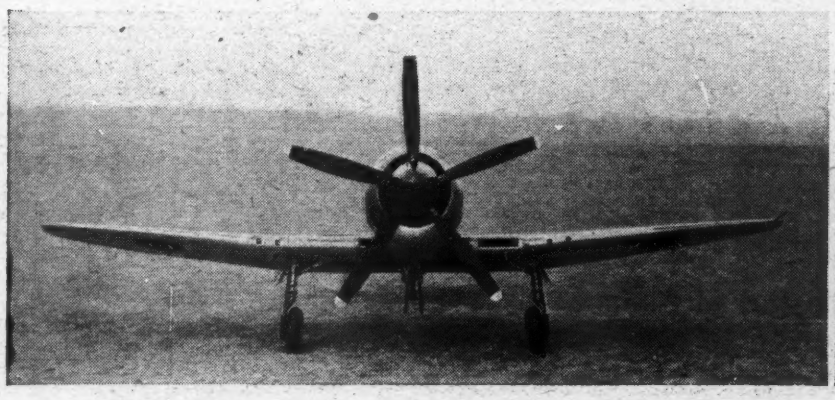
Pilots who fly the Fury seem all to be agreed that it is a truly delightful machine to handle, and has none of the idiosyncrasies which beset its predecessors. Control response is said to be really excellent, and the rate of roll is extremely fast (well in excess of 100 deg. per second) and these qualities can both be regarded as being directly attributable to the patent Hawker spring servo-tabs—although in the case of the rate of roll the reduction in span is undoubtedly a contributory factor.

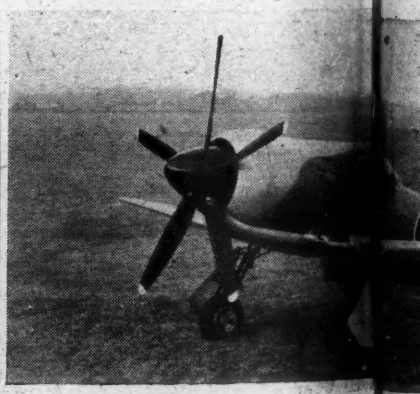
Spring servo-tabs are fitted to each aileron and to the rudder, but not to the elevators; the ailerons are not fitted with trimming tabs whilst the elevators are; and for the rudder a rather ingenious arrangement permits the servo-tab to be used also as a trim tab. The Hawker spring servo-tab employs a torsion bar as the spring element, one end of which is anchored to the parent control surface and the other to the control linkage from the cockpit. Thus the pilot's control input force has to be transmitted through the torsion spring and, as the air load on the surface is always greater than the initial deflection value of the spring, the latter will twist and so move the tab which, in turn, will cause the parent surface to be deflected the requisite amount. In the case of the rudder, that end of the torsion spring element which is normally anchored is, instead, fitted with a segment of a worm wheel with which engages a worm controlled by the trim wheel in the cockpit. By this means the median position of the spring can be adjusted to move the tab to one side or the other of the neutral position, and so allow it to be used as a trim-tab without in any way impairing its use as a spring-tab.

Pilots new to the Fury will be glad to find that it has a cockpit floor, so that when something is dropped it is no longer lost in the tortuous viscera beneath the seat. The floor itself slopes upward from seat to pedals so that the latter are approximately on a level with one's *derrier* when this is esconced on a dinghy and parachute. Such a seating position is by no means as uncomfortable as it sounds, and, in conjunction with the spring-loaded seat, is of undoubted benefit as a partial neutraliser of g-effect. This reorientation, allied to the greater width available in the cockpit, has allowed a reversion to the direct-action control column in place of the wrist-action type with which we have become so familiar on fighter aircraft.

Cockpit layout in the Fury is good, the instruments being arranged rather similarly to those of the Tempest; but the provision on each side of ledges, or trays, in which are mounted the controls for various

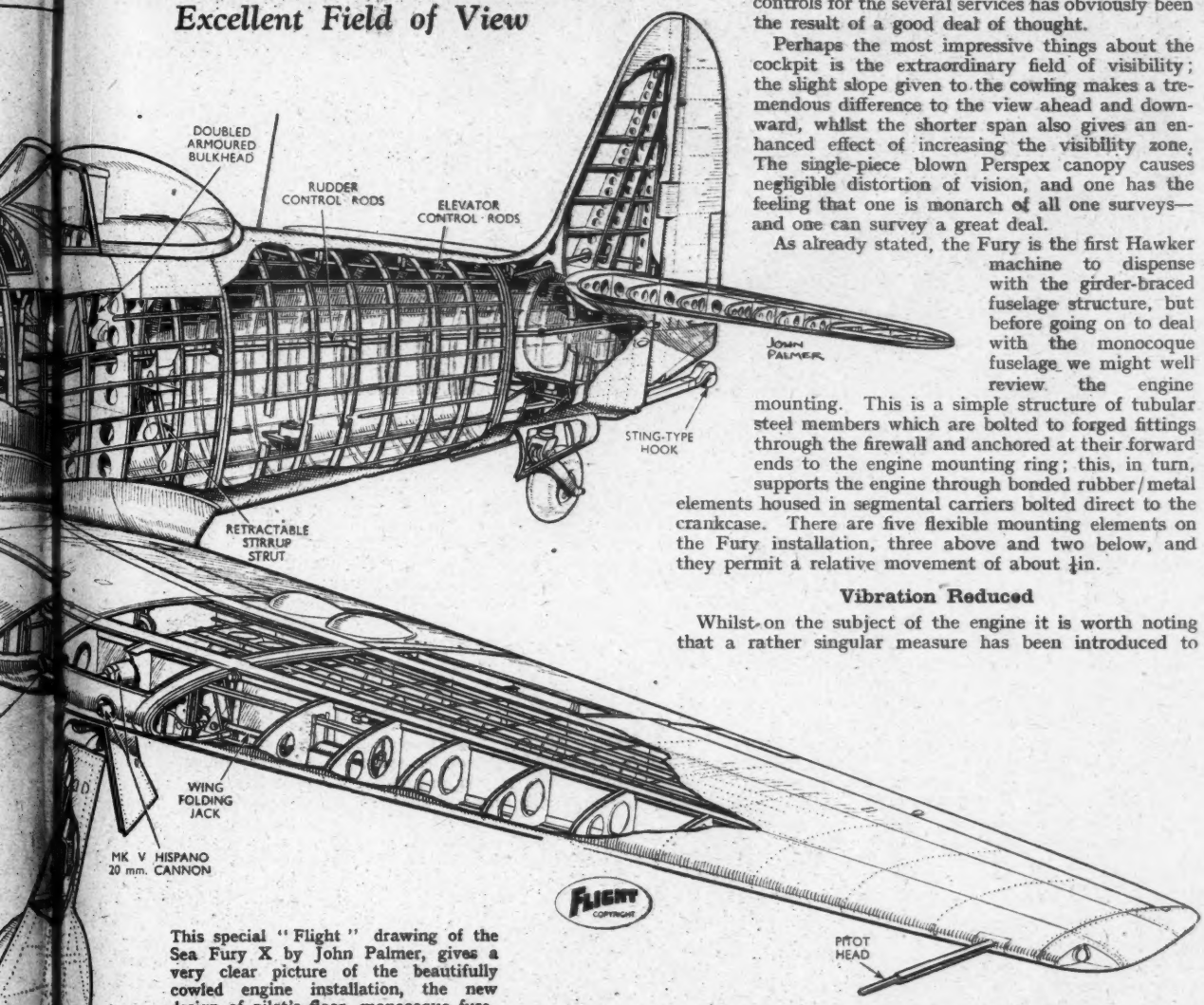






2,400 b.h.p. Bristol Centaurus XVIII

Excellent Field of View



This special "Flight" drawing of the Sea Fury X by John Palmer, gives a very clear picture of the beautifully cowled engine installation, the new design of pilot's floor, monocoque fuselage structure and disposition of units in the very thin wing. It also amply illustrates the excellent order of forward and downward view.

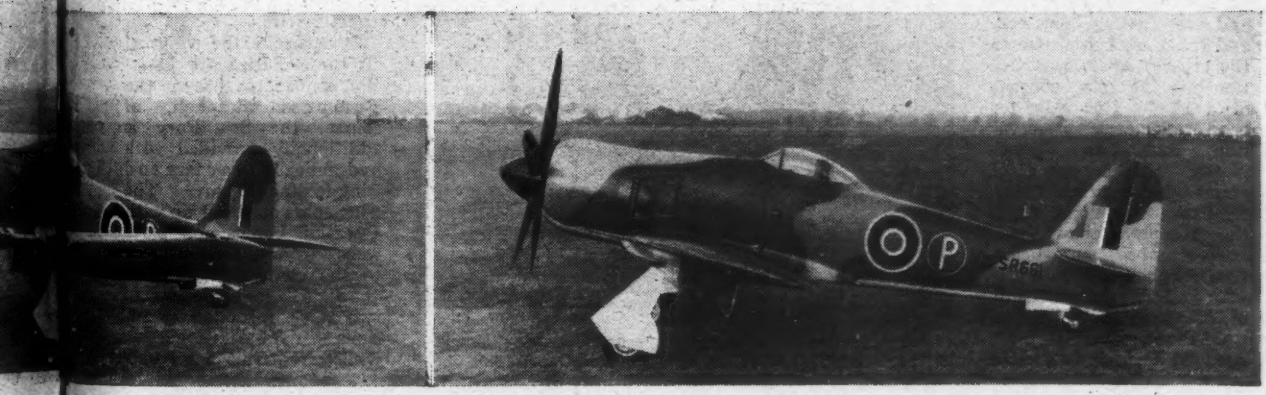
ancillaries, is a very convenient feature. Everything comes nicely to hand and the grouping of controls for the several services has obviously been the result of a good deal of thought.

Perhaps the most impressive things about the cockpit is the extraordinary field of visibility; the slight slope given to the cowling makes a tremendous difference to the view ahead and downward, whilst the shorter span also gives an enhanced effect of increasing the visibility zone. The single-piece blown Perspex canopy causes negligible distortion of vision, and one has the feeling that one is monarch of all one surveys—and one can survey a great deal.

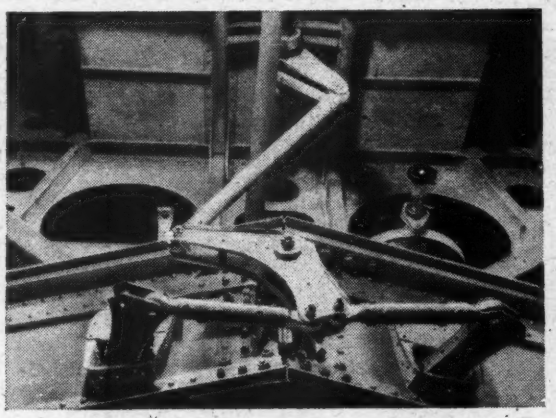
As already stated, the Fury is the first Hawker machine to dispense with the girder-braced fuselage structure, but before going on to deal with the monocoque fuselage we might well review the engine mounting. This is a simple structure of tubular steel members which are bolted to forged fittings through the firewall and anchored at their forward ends to the engine mounting ring; this, in turn, supports the engine through bonded rubber/metal elements housed in segmental carriers bolted direct to the crankcase. There are five flexible mounting elements on the Fury installation, three above and two below, and they permit a relative movement of about $\frac{1}{4}$in.

Vibration Reduced

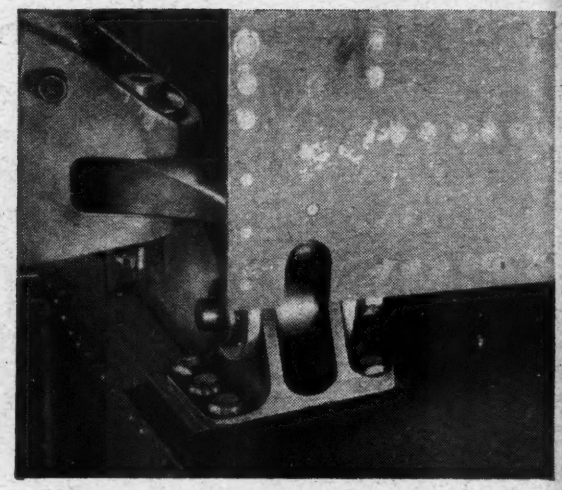
Whilst on the subject of the engine it is worth noting that a rather singular measure has been introduced to eliminate some of the undesirable vibration that characterised the Tempest II. The radial disposition of the master connecting-rods in the Centaurus was previously 160 deg. as between the front and rear rows of cylinders, but by the simple resort of changing round the master rods



SEA FURY X



View from below of rear spar joint at centre line with aileron control transmission linkage.



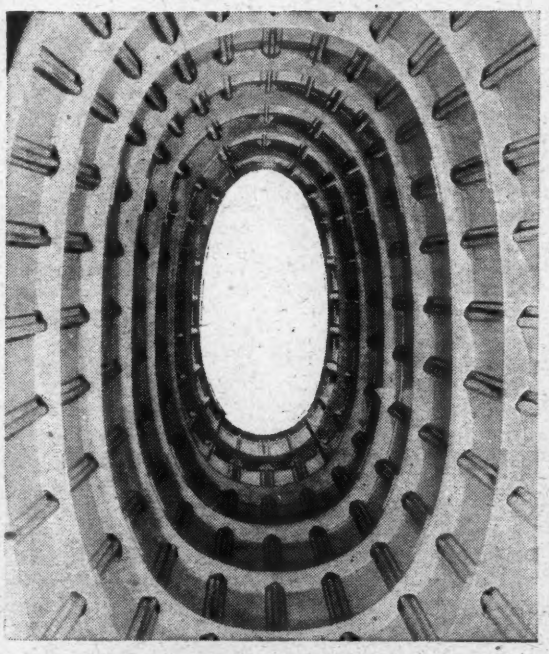
Detail of wing/fuselage attachment at front spar, and lower port anchorage of engine mounting.

so that they serve adjacent cylinders, their angular disposition has been changed to 20 deg., and this has had the effect of so reducing vibration that the results are, in the words of one of the pilots, "revolutionary." It should be pointed out that whilst this measure is applicable to the Fury airframe it would not necessarily have the same effect in another aircraft in which the inherent vibration periods might well be different.

Aft of the front bulkhead-firewall, which is built above the front spar, are housed two fuel tanks, the main tank of 94-gallon capacity being interconnected with a 30-gallon auxiliary tank housed aft of it immediately beneath the rudder pedals. Two 28-gallon inter-spar tanks, one in each wing, and the 20-gallon nose tank in the starboard leading edge all feed into the main fuselage fuel tank, from the sump of which the fuel is fed to the engine.

The centre fuselage, which embraces the cockpit, is a monocoque structure comprising four main longerons and a number of hefty frames notched for intersection with the top-hat stringers. Wing attachment is made at the front spar, by single bolts in forged fittings, to the base of the front bulkhead, and at the rear spar by similar fittings anchored to the base of a main-frame immediately forward of the pilot's seat. Plain angle extrusions form butting members at the joint between centre and rear fuselage portions, and these are bolted one to the other. Armour protection for the pilot consists of a single ½in. slab for head and neck preservation, and two thinner plates, with a space of about 4in. between them, for back protection. As in the Tempest, the miscellany of impedimenta below the cockpit floor would provide at least some measure of deflective protection.

Of the rear fuselage, little need be said; it is a plain monocoque of Z-section frames and half- and full top-hat stringers, the frames being notched for intersection. Control transmissions for rudder and elevators run respectively along the port side and in the centre of the "roof," and, unusually, are made up of short lengths of push/pull tube pivoted to idler links. There would seem to be great merit in this system, for not only is static friction reduced to a negligible quantity, but the transmission is absolutely positive and needs no adjustment.



Looking rearward through monocoque showing simple, light structure of stringers and frames.

Tail Surfaces

The tail unit comprises a single-piece tailplane assembled by passing it through an aperture in the base of the integral fin and bolting it to attachment fittings on the frames of the fuselage tail end. Elevators are fully balanced and are, like the rudder, carried in conventional self-aligning bearings; the rudder is covered with a pre-stretched metal skin and, by so being, makes the Fury the first completely all-metal Hawker aircraft.

A sting-type arrester hook is fitted beneath the rudder (which has, therefore, been reduced slightly in area) and when the hook is released, the light spring in the telescopic hook strut causes it to extend about 12in.; an oleo-pneumatic snubber prevents the hook from bouncing along the deck and so ensures that it engages the first available arrester wire.

Structurally the wings of all three Furies are basically similar to that of the Tempest although, of course, the Sea Fury is additionally provided with hydraulically actuated wing-folding gear. The wing spars are built up with T-section booms and plate webs; from the centre line to the change in dihedral the "T" is made up of two thick L-section extrusions riveted together, whilst from this point out-

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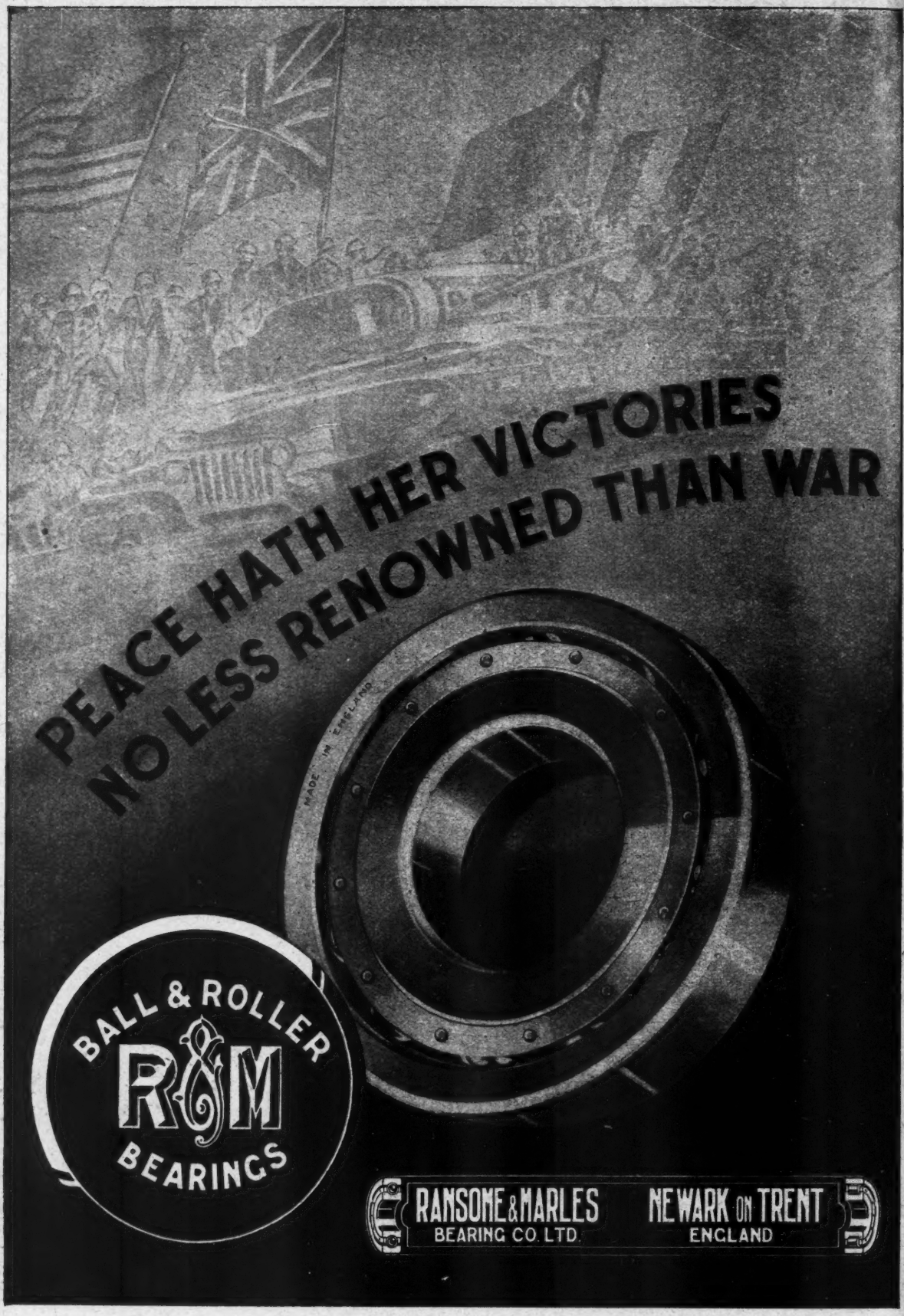
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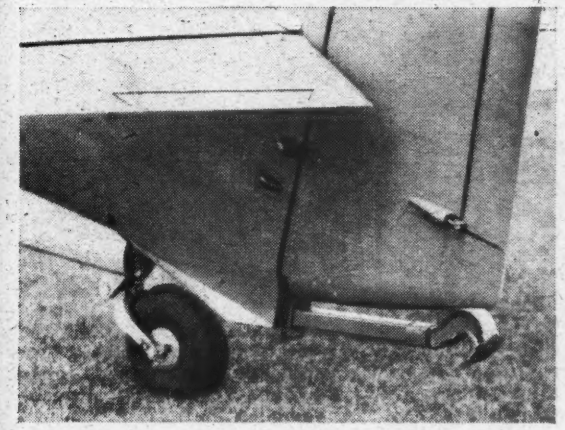
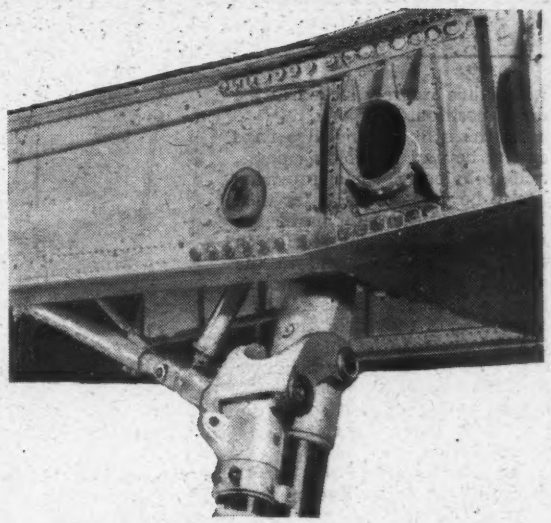
SEA FURY X



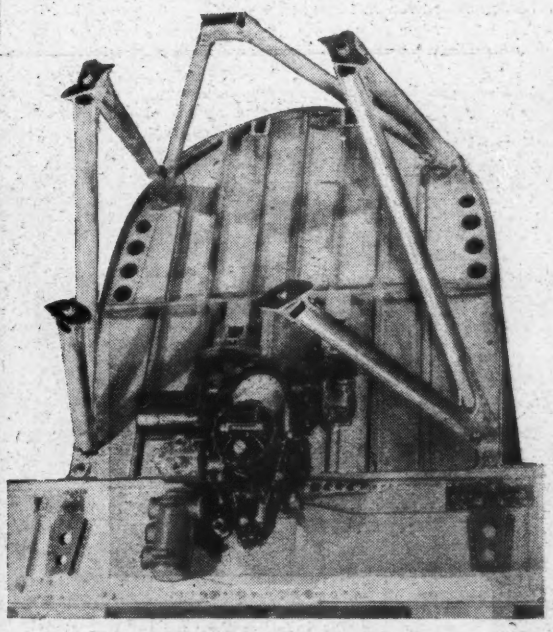
Detail of rear end showing the sting-type hook, levered suspension tailwheel and rudder servo-cum-trim tab.



Front spar joint at dihedral break showing the inboard cannon aperture and port undercarriage bracing struts.

board the booms are of normal extruded T-section. Spar joints both at the centre-line and the dihedral break are effected with high-tensile steel shackle straps through-bolted to the booms with butt-straps to the webs. Chordal ribs are all of the pressed-sheet diaphragm type, notched for intersection with the stringers to which the skin is riveted. Commonly with the Tempest, the rear spar is cranked sharply forward to the dihedral break; this measure allowing the breech mechanism of the cannon and the ammunition boxes to be installed behind the rear spar, where they are easily accessible for servicing and re-arming. A torsion box encloses the gun bay; it is made up of the front and rear spars, the interspar bounding ribs, and the heavy-gauge sheet top and bottom skin covering.

Carburettor air-intake ram-heads are fitted in the wing-root leading edges port and starboard. In the leading edge of the port wing, immediately outboard of the intake,



Firewall bulkhead on front spar showing engine mounting structure and Rotol auxiliary gear box.

the oil-cooling radiator is fitted, hot air being exhausted through a slot in the under surface of the wing forward of the front spar. A 20-gallon fuel tank in the starboard leading edge outboard of the root intake complements the oil cooler in the port wing.

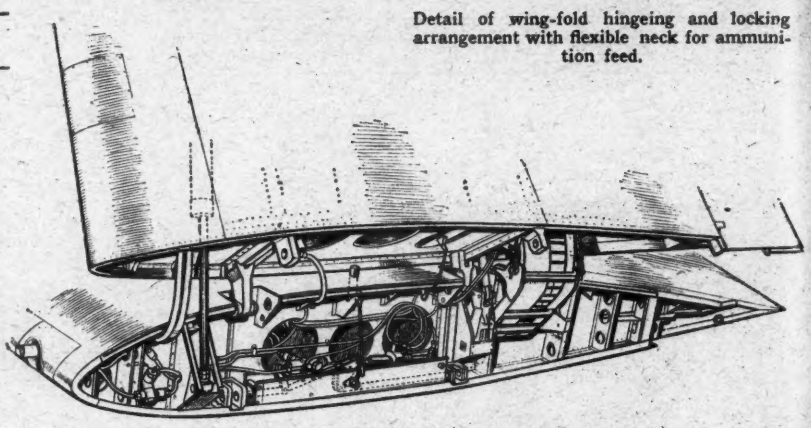
The Fury undercarriage is almost identical with that of the Tempest insofar as its structure is concerned, although, as previously stated, the wheel track has been reduced. Each undercarriage leg comprises two struts joined together by link arms to provide parallel motion; the shock absorber unit is fitted in the rear strut and is pinned to the lower link arm, thus providing a form of levered suspension as the wheels are carried on cantilever axles at the base of the front strut. This special form of undercarriage was devised to permit retraction into the very thin wing which, we might here point out, is a special high-speed section developed by Hawkers.

With a maximum depth of section at 37.5 per cent. of the chord, and thickness/chord ratios of 14 per cent. at the root and 10 per cent. at the tip, this aerofoil section has excellent characteristics over the whole speed range. However, the section was primarily designed for high-speed conditions and, owing to the fact that there are no sharp changes in the pressure gradients, the onset of compressibility effects is delayed and the Fury is thus able to manœuvre at very high speeds without adverse effect on stability or control.

Wing Folding Gear

The provision of folding wings has occasioned very little trouble with the Fury, and the solution to the problem is remarkably simple. The folding point comes immediately outboard of the gun emplacements, and forged high-tensile steel fork-end- and lug-fittings bolted to the spars are the stress-carrying members, those to the top booms of each spar being the hinges and those to the bottom booms acting as latches. Wing folding is a power service on the Sea Fury; a hydraulic jack in the outboard wing panel has its rod pivotally anchored in a box on the end rib of the inner wing, extension of the jack causing the outer wing panel to hinge upward. However, the latch pins must be withdrawn to unlock the wing for folding, and this is automatically arranged very ingeniously by a sequence operation in the hydraulic circuit. A sequence valve on the inboard wing end-rib is served with oil and feeds it to a small jack which, through a simple toggle mechanism, withdraws the latch pins; the flow of oil is then automatically transferred by the sequence valve to the main wing-folding jack and the wing is lifted. The reverse process ensures that when the wings are lowered the latch pins are thrust home and the

SEA FURY X



Detail of wing-fold hingeing and locking arrangement with flexible neck for ammunition feed.

wings thus securely locked in the down position.

As the split trailing-edge flaps extend beyond the folding point, quite obviously some provision has to be made to allow for this. The flaps on the outer panels are spring loaded to maintain them in the "up" position, and in the inboard edge on the outer flap is fitted a "bullet" plunger which engages in a socket in the outboard edge of the inner wing flap; thus it is that only the inner flaps are positively driven, the motion being transmitted to the pre-loaded outer flaps through the simple plunger and socket device.

The skin surface of the Fury is very good, but that of the wings from the leading edge to 30 per cent. of the chord is really excellent, rivet heads being rubbed down and filled to provide a continuity of surface which ensures the very least disruption of airflow—an essential quality when a high-speed aerofoil section is employed.

PRINCIPAL DATA AND PERFORMANCE FIGURES

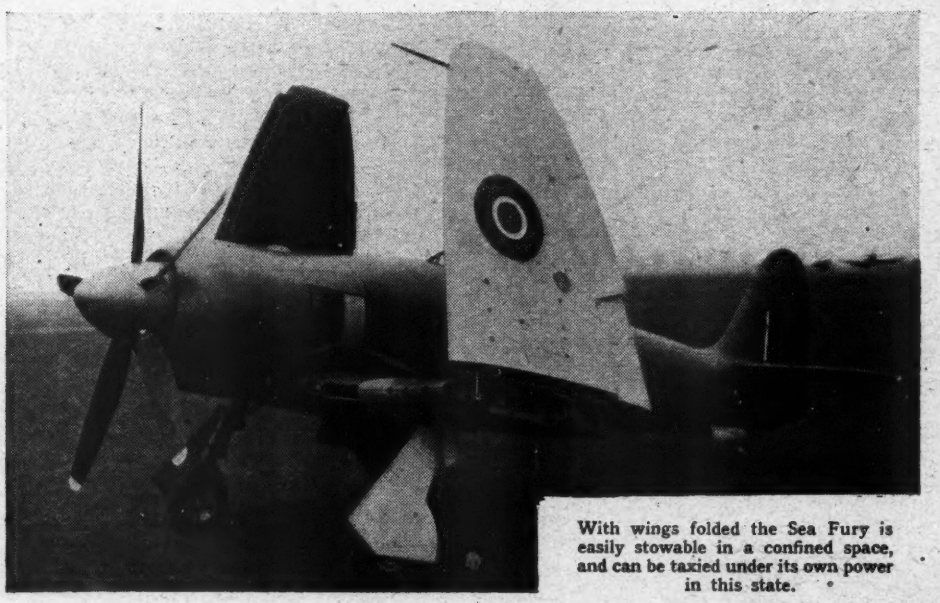
Bristol Centaurus XVIII Engine with 5-blade Rotol 12ft. 9in. dia. airscrew. Gear ratio : 0.444 : 1. Solidity : 0.153.

	M. Gear	S. Gear
Take-off power	2,300 b.h.p.	—
Combat power (5 min.)	2,400 ,,	2,400 b.h.p.
Max. power up to 30 min.	2,100 ,,	1,920 ,,
Max. cont. cruise power (R.M.)	2,100 ,,	1,920 ,,
Max. cont. cruise power (W.M.)	1,600 ,,	1,450 ,,

Maximum speed (T.A.S.)	460 m.p.h. at 18,000ft.
Maximum rate of climb	5,640 ft/min. at S.L.
Time to 30,000ft.	8 minutes
Optimum economical cruise speed	207 m.p.h. I.A.S.
Rad. of action with extra 90-gall. in drop tanks	520 miles

Wing area	280 sq. ft.
Aspect ratio	5.26
Aerofoil	Hawker High-Speed
Mean chord	7ft. 4in.
T/C ratio—root	14.5 per cent.
tip	10 per cent.

Incidence	2½ deg.
Dihedral (outer panels)	5½ deg.
Wing loading	43 lb/sq. ft.
All-up weight	12,030 lb.
Percentage structure weight	29
Percentage power-unit weight	38



With wings folded the Sea Fury is easily stowable in a confined space, and can be taxied under its own power in this state.

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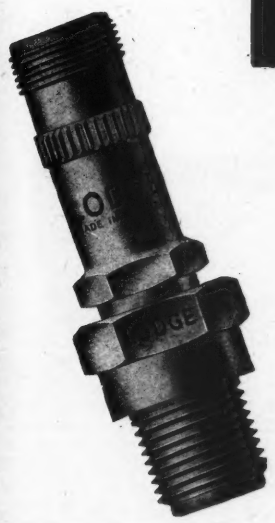

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E

IN THE AIR IX (PART II)

A Spitfire Score

From the IX to the XXII : Trimming Problems : The Griffon-Engined Series

By "INDICATOR"

WITH the Spitfire, lateral trim always provided some interesting little problems. In the early days of fabric-covered ailerons the usual "cording" method was used, and then, when the change-over to metal surfaces came, the trailing edge used to be reflexed sharply to produce much the same results. Still later, it became customary to obtain even, or nicely averaged, lateral trim by the cleaner and more civilised expedient of "dressing" or "planishing" the aileron trailing edges over the whole length, using a wooden mallet and a supporting block.

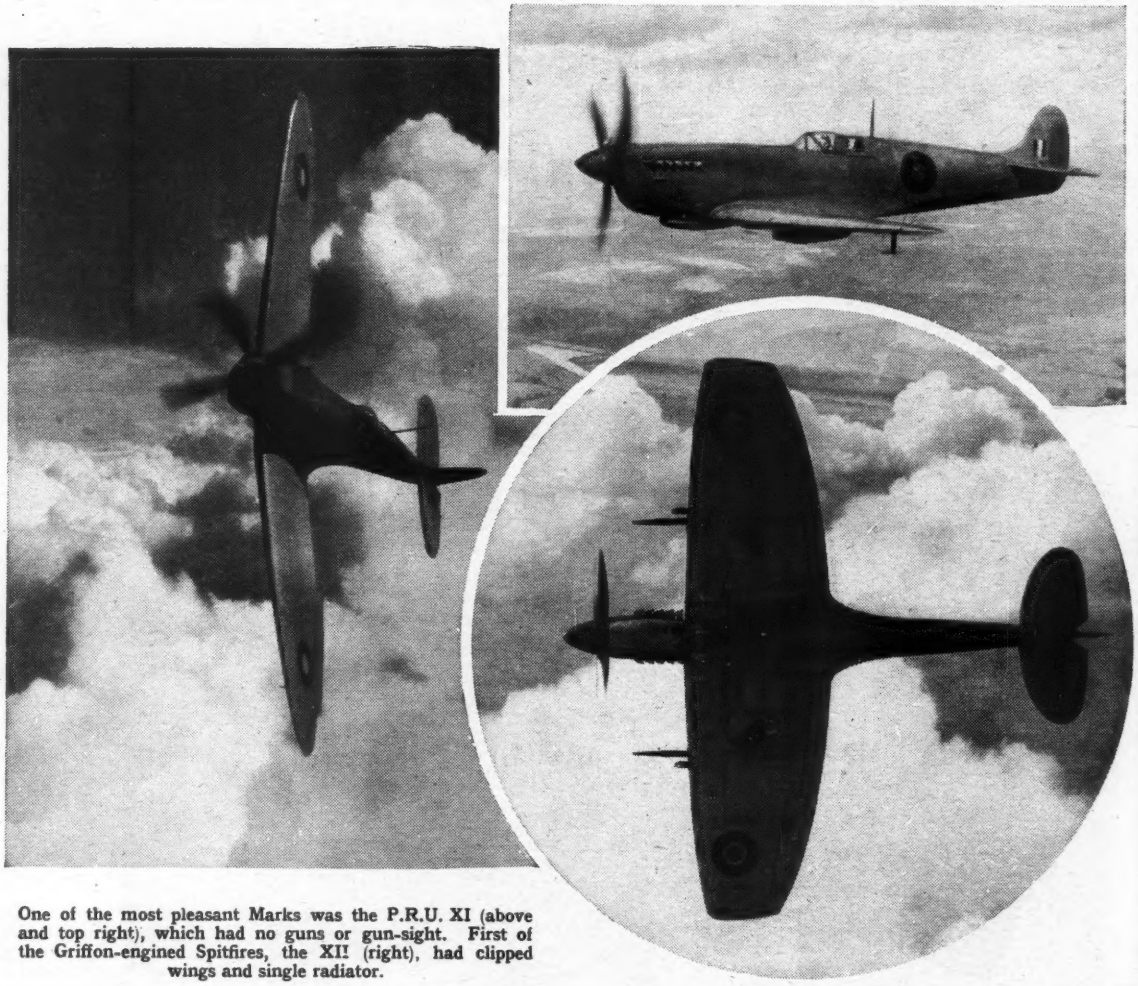
Excellent in theory though this might be, the fact remains that, for one reason or another, only adjustments to the inner foot or two of aileron edge usually produced any marked effect on the trim, and it was sometimes necessary to "dress" the edge almost to the extent of using the much-despised reflex method.

Needless to say, the different test pilots' equally different methods of indicating trimming defects could cause a good deal of doubt and despondency on the ground. Some, in their reports, wrote in terms of "inches" of lateral trim defect, and others in still more mysterious "degrees," while all had their own particular standards of measurement in the different Einsteinic universes of their own imaginations. It was a good rigger who could translate the trimming requests of two or three different pilots, each speaking a different "language," with any real accuracy.

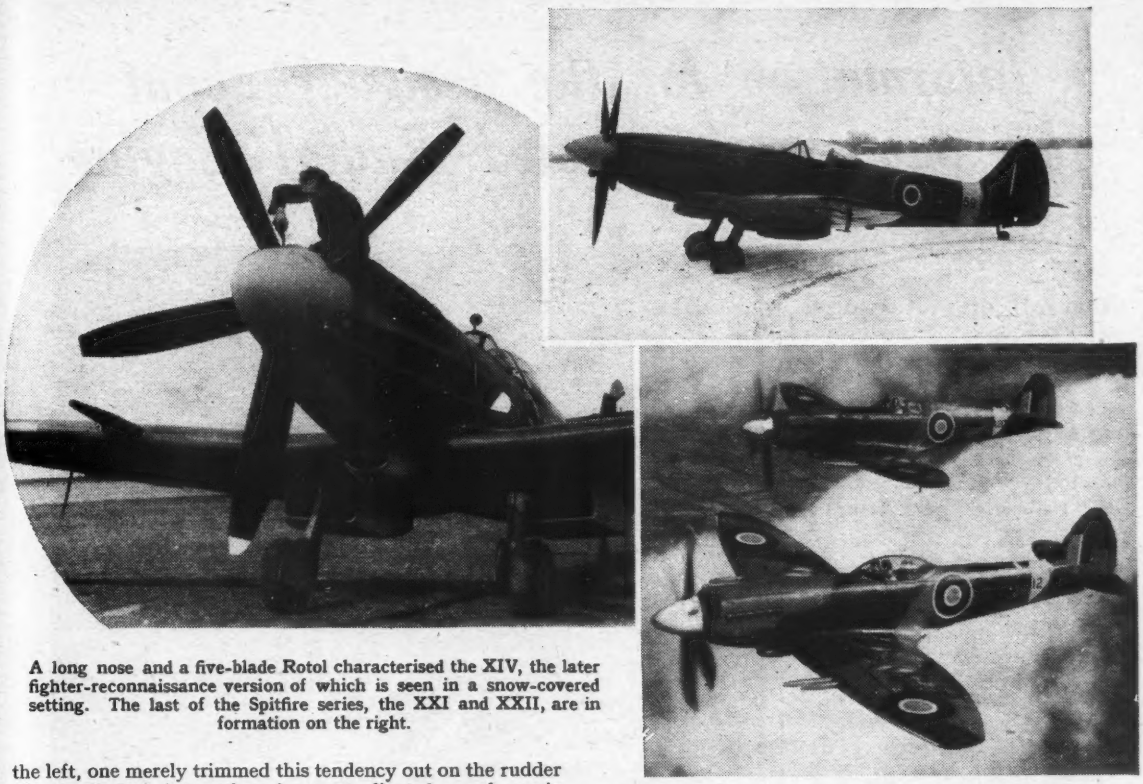
Trimming by Degrees

The "inches" were a relic of the days when we either laid lengths of cord on the aileron's upper trailing edge, or bent the edge sharply along so many inches of span. The measurement by the "degree" system—the ingenious idea, I believe, of a certain Maintenance Unit test pilot, and applicable only to one or two types—was even more mysterious to the uninitiated, though really very simple.

When a particular aircraft was, say, tending to roll to



One of the most pleasant Marks was the P.R.U. XI (above and top right), which had no guns or gun-sight. First of the Griffon-engined Spitfires, the XII (right), had clipped wings and single radiator.



A long nose and a five-blade Rotol characterised the XIV, the later fighter-reconnaissance version of which is seen in a snow-covered setting. The last of the Spitfire series, the XXI and XXII, are in formation on the right.

the left, one merely trimmed this tendency out on the rudder bias until, by virtue of various complicated aerodynamic forces, the aircraft would fly level while, of course, skidding quietly along to the left. The top needle of the Watney, Combe and Reid showed the amount of this skid, and there you were. This amount varied in complicated proportion to the amount by which one's aircraft would normally, when properly trimmed directionally and left to itself, have been trying to roll. It was a quite mechanically standard method of indicating the amount of lateral trim error, and all pilots would produce the same answer for the same aircraft at the same speed. Unfortunately, however, four degrees of indicated skid, say, were by no means the same as twice two degrees of skid when translated into lateral trim terms. The unfortunate rigger had to think that one out, and he very quickly learned to do so.

There were, occasionally, those awful moments when an aircraft off the production line would be tending to roll violently over one way while already having a near-limit upfloat tendency on the opposite aileron. Obviously, it was not possible to dress the aileron to correct the trim without still further increasing this upfloat. Results could sometimes be obtained by a judicious hammering of the shrouds, but it usually meant a complete aileron change and sometimes even a complete wing change.

Pleasure Riding

By way of relief from the old original pressure-cabin types, the Mark XI P.R.U. Spitfire was quite the simplest and most easy-going affair designed for medium high-altitude work and for a high speed. There was no pressure-cabin and, most delightful of all, no gun-sight to restrict one's forward view. In place of the bullet-proof screen was a pleasant one-piece moulding which, with the canopy, gave an unrestricted view of the entire upper hemisphere. It carried no guns, though there were two extra wing tanks well outboard, the contents of which were indicated on two extraordinary gauges which seemed always to indicate the same amount, whether the tanks were empty or full. The line to take was that of running each of them dry—then at least you knew where you were.

First of the Griffon-engined Spitfires, the XII seemed to behave simply as a Mark V, with more power and a swing in the opposite direction, i.e., to the right. In the early days, when flying these later Marks, it required something of an effort of memory to set the rudder bias correctly—though nothing very terrible happened, other than to the muscles of the left leg, if the fact that the aircraft was Griffon-powered had been forgotten. But the XII had a new and rather special noise which we were to learn to like as more and more XIIs and XIVs came into the market. Remembering the old days of the II, we were once again to become accustomed to the cartridge-starting procedure. Although the actual stalling speed, even at the greater all-up weight, appeared to be virtually unchanged, the XII and later Griffon Marks had a pleasant way of staying much more firmly on the ground after touchdown in rough conditions

One of the more mysterious troubles with which aircraft are sometimes beset appeared with a particular XII which had already done quite a good deal of flying. This aircraft developed a power-surging tendency which was tantamount almost to a series of dead cuts—and always at high speeds. The constant-speed unit was at first suspected, and hopes of a cure were high when the inside of the mechanism was discovered to be both worn and very dirty. But the surging continued. In turn the c.s.u., the airscrew, and even the carburettor were changed, with no perceptible result.

Only a long series of very earnest diving tests at different boosts and c.s. settings brought to light the definite fact that the violence of the surging increased primarily with the speed—320 m.p.h. appeared to be the critical "starting" speed—and, to a lesser degree, with the number of the revolutions and the degree of boost. Obviously, therefore, the trouble was bound up with some variation in "ram" effect, and it was eventually discovered that, through a fault, the shape of the intake was being changed by the increasing air pressure. It was not actually closing up so much as distorting, and neither the boost control nor the c.s.u. could cope with the violent alternations in outer intake pressures.

Some of the characteristics of the Spitfire family, and of

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•

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•

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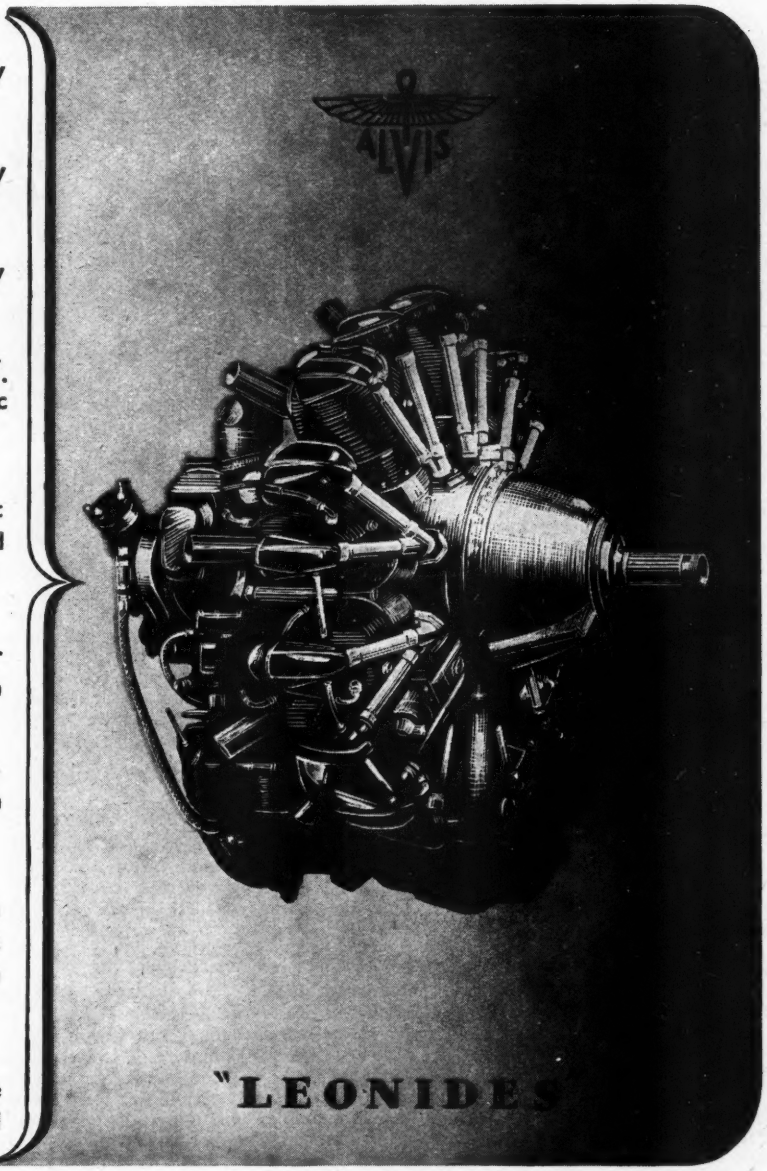


ALVIS *Aero Engines*

ALVIS LIMITED, COVENTRY, ENGLAND

A SPITFIRE SCORE

the XIV in particular, were given in *Flight* of August 16th, but there was one difficulty which came to something of a climax in testing later versions of this type. Although earlier Marks had been fitted with what were known as "interconnected" or "automatic" engine controls, the boost-revolution situation could sometimes be quite remarkably acute when making adjustments to the XIV.

In this, no very useful check results could be obtained during the ground run, since the c.s.u. never had a chance of taking the blades off the stops except at boost levels not permitted on the ground. On run-up the boost was, so to speak, always ahead of the revolutions, the airscrew was always in fine pitch, and one never knew whether the c.s.u. was functioning, or, least of all, whether the "interconnected" and "stop" settings were correct.

There were two constant-speed stops ("automatic" and "override") and one setting for minimum revolutions, as well as a couple of control rods on which intermediate adjustments could be made, while there were also boost capsule adjustments and stops in the throttle gate—the movement on any of which could change the relationship between power and revolutions. Certain tolerances were permitted and the fitter had to strike a nice average, using boost and interconnection adjustments in unison, to obtain all-round results with both boost settings and revolution readings within their permitted range of tolerance. Nevertheless, with an expert in attendance, it was only necessary to bring back a series of complicated and apparently uncoordinated figures for immediate and correct results to be obtained on the next flight.

One should, of course, include the Seafire variants amongst all the rest. The III, in particular, was remembered for its light, almost over-light, aileron control, while the XV was almost entirely similar to the XII. We liked the Seafire III rather specially, not only because it handled so well, but because, in the later stages, when nearly all Spitfires were fitted with gigantic gyro gun-sights, the Seafire was still fitted with the old-fashioned reflector sight. And there were no interconnected controls about which to worry.

While layout and general characteristics were slightly though irrevocably altered on the introduction of the XIV, the final change from essential "Spitfireness" really came before the arrival of the Spiteful—with the XXI and XXII. In nearly all aircraft the basic handling characteristics are concerned very largely with lateral control, and, from this point of view, the XXI was a different type. In the natural course of development for higher speeds it was necessary to introduce geared servo tabs for the ailerons and, pleasantly light though these made them, the ailerons lost their original "feel" and became soulless. Nice though the XXI was, with its taller and wider undercarriage and its more than ever joyous performance, it had ceased to be a Spitfire.

Maybe I'd lived for too long on the earlier Marks and was of a naturally conservative nature, but, to me, the epitome of the Spitfire was in its years of middle development. Even so good an aircraft could, eventually, be over-developed.

New Profile Projector

Objects Up to 6in. Diameter Magnified Ten Times

PROFILES of flat and circular objects—such as form tools, press tools, templates, plate gauges, gear teeth, screw threads, and hobs, up to 6in. diameter—can be projected at a magnification of ten by means of the profile projectors recently introduced by Taylor, Taylor and Hobson, Ltd., of Leicester. The instrument is a development of the firm's well-known earlier model, the 200 projector, which has a maximum field of 3in. diameter at a magnification of 20. The new large instrument makes use of the same range of lenses as the smaller with the addition of a new lens designed specifically for profile projection and having an optical field of 6in. diameter and a magnification factor of ten.

Parallel light beams are, of course, essential, otherwise a round object such as a sphere, for instance, would have not its maximum but a smaller diameter projected. In the new instrument a suitable collimating lens has been included.

In operation the work is positioned with the cross-section of the profile normal to the axis of projection. It is so set that it intercepts a beam of collimated light in its passage to the projection lens, so transmitting an enlarged shadow of the profile, via the projection lens and two mirrors, to the viewing screen. The optically flat mirrors are supported at appropriate points to avoid distortion.

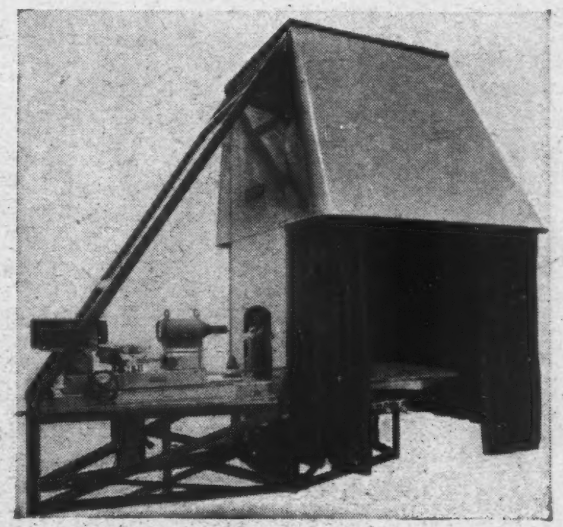
Oblique Projection

For the projection of oblique objects, such as a screw thread, it is necessary that the beam of collimated light shall be inclined through an angle equal to the helix angle of the thread. The limiting helix angle for the new instrument is 15 deg.

The standard optical systems available for use with the projector each comprise a projection lens with its appropriate collimating lens. The collimations are as follows:

Combination number	Magnification	Focal length (in.)	Diameter of work field (in.)	Working clearance (in.)
I	100	2.00	0.60	0.85
II	50	4.00	1.20	1.86
III	30	6.66	2.00	3.12
IV	20	10.00	3.00	5.04
V	50	4.00	0.50	2.12
VI	10	20.00	6.00	10.62

With the exception of combination V, which is designed for screw-thread and similar work, all combinations are intended for the projection of normal profiles. The lenses are free from distortion. The source of illumination is a 250-watt projector lamp accurately pre-focused and with a specified filament size. The lenses are interchangeable and are mounted with their axes horizontal. The work is supported on a horizontal table, and the screen, which may be rectangular or octagonal, is of hardwood construction, so mounted as to avoid warping or distortion. The maximum vertical separation between the axis of projection and the work table is 6in.



The new Taylor-Hobson outfit.

Halton School

The "Public School of the R.A.F." : Comprehensive Training for Aircraft Apprentices

THE term "ex-apprentice" in the Royal Air Force is synonymous with sound training. Any officer or airman who is an ex-apprentice has received the finest service training that is available, for usually he has joined the R.A.F. straight from school, and he has invariably completed three years' apprenticeship before being posted to a Service squadron.

Twenty-six years ago Viscount Trenchard, then Chief of the Air Staff, concelved the aircraft apprentice scheme. He realised that only the most highly skilled tradesmen could ensure an efficient Air Force, and that such tradesmen were not readily available. To form the necessary nucleus of such men, it was essential to begin with the best possible material, for, as befits a technical service, the recruits needed to have reached a good educational standard, to be capable of assimilating advanced technical knowledge and training, and to be medically fit.

The first entry of 235 aircraft apprentices was sent to Cranwell for training in various trades in February, 1920, but of the entry in January, 1922, half went to Halton, and thus No. 1 School of Technical Training began. In 1926 the fitter apprentice entry at Cranwell was also transferred to Halton, which henceforward was entrusted with the training of all the mechanical trades, and, to date, over 18,800 ex-apprentices have passed out from the school. Of this number, well over 4,000 have attained commissioned rank—a tribute to the quality of Halton's instruction.

Anyone who looks around Halton realises at once that it is no ordinary R.A.F. station. It has an atmosphere such as is engendered only by tradition, and when one sees the long list of high honours and decorations awarded to ex-Halton boys, one knows that the training has not been in vain.

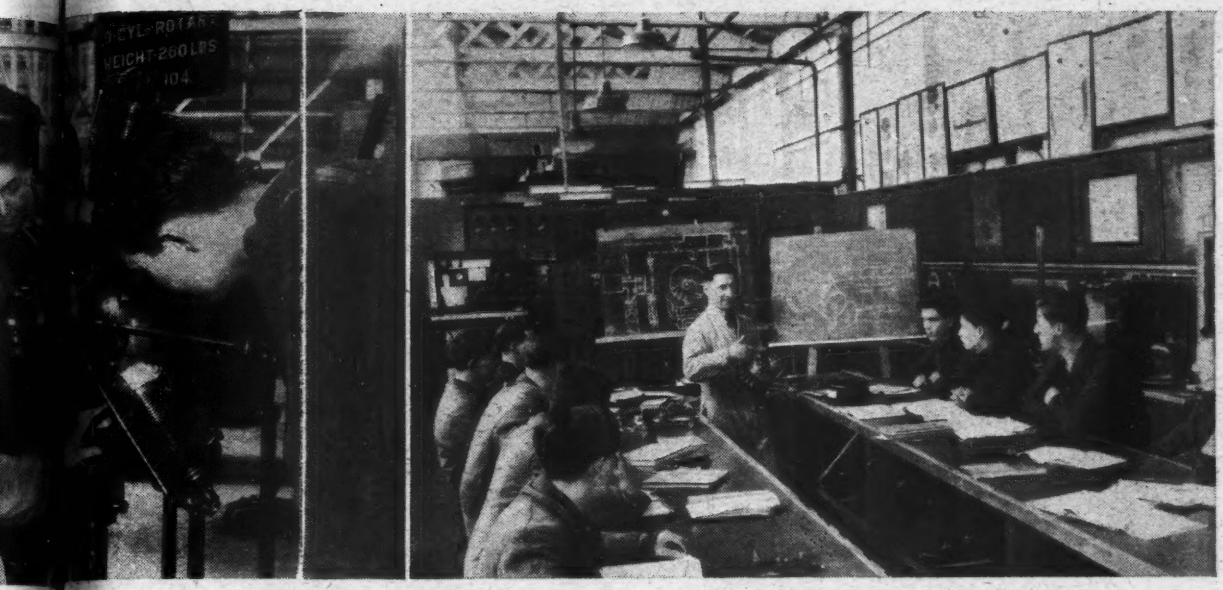
The station is spacious and well laid out. Everything is orderly, and the barrack blocks particularly are a model of cleanliness and good order. The boys lay out their kits with absolute precision, not merely because there is a trophy for the best barrack room, but because there is, clearly, a personal pride which is all too uncommon nowadays. The polish on floors and accoutrements is such that it is easy to believe the rumour that apprentices have been known to remove their shoes at the threshold of the barrack room and walk across the room in stockinged feet to avoid spoiling the look of the floor. This cleanliness and care is not peculiar to the barrack room, however. Every part of the school reflects the same pride and tradition, even to the boiler room, where truly one could "eat one's food off the floor."

Education and—

The average age of the apprentices is about 16½ years. To be eligible for entry to the school they must be between the ages of 15½ and 17, and also be educated up to school certificate standards, or pass an equivalent entrance examination. During their three years at the school, the boys continue their education, and, irrespective of the trade for which they are ultimately trained, all undergo a common course for the first year, covering such subjects as English history, mathematics, aeronautics, engineering science, drawing and mechanics. In addition, they are given General Service Training, which aims at turning them into thoroughly disciplined airmen, for every apprentice signs on for twelve years' continuous service with the R.A.F. from the age of 18.

At the end of the first year each apprentice is interviewed by a Central Trade Test Board, and, depending on his progress during the year and his natural inclinations, he is selected for training in one of the Fitter or Mechanic trades. At present five trades are covered at Halton: Fitter (engine), Fitter (airframe), Fitter Armourer, Electrician and Instrument Maker, and every effort is made to train each apprentice in the trade for which he is most suited.

This is not a showpiece. A smart turn-out and a spotless barrack room are just a part of the Halton tradition.



Technical training at Halton is thorough and embraces all types of aircraft and aircraft equipment including the jet engine. (Left) Apprentices examine a 1915 Monosoupape rotary engine. (Right) A class studies the intricacies of "George."

In the workshops and lecture rooms all the familiar types of Service aircraft, engine, or aircraft equipment seem to abound. Capacious workshops—pleasantly warm on a cold winter's day—display engines ranging from the Gnôme to the jet, and also the fuselages of most modern Service aircraft. Working models are there, too, cut away to show the more intricate mechanisms. Aerodynamics, electronics and other mysteries are explained and demonstrated, and there are wind tunnels for testing model airframes and aerofoils.

—Practical Training

On the practical side, the apprentice begins by learning the more straightforward tasks such as how to splice, or to use a file, or lathe, and, until he is judged proficient at these tasks, he does not progress to the more difficult exercises. Bit by bit, he learns engineering science—in theory and practice—and then applies it to the modern aircraft; so that, at the end of his training, the Halton apprentice has not only a sound theoretical background, but is also skilful manually. In fact, it is a little disconcerting to the visitor to see a lad of seventeen assembling and wiring on an outsize blackboard all the involved electrical equipment of a fighter aircraft.

On the results of his final examinations and trade testting the aircraft apprentice is graded for his service in the R.A.F. Subject to having reached a qualifying educational standard, he passes out L.A.C., A.C.1 or A.C.2 in his trade, thus determining his future rate of pay. Incidentally, the apprentice receives pay during his training at the rate of 10s. 6d. per week for the first two years, and 14s. per week for the third year.

The aircraft apprentice's life is not all work, however. On the contrary, his working hours leave a good deal of time for recreation and private hobbies, and he has six weeks' leave each year. For a nominal two shillings a year he becomes a member of the Halton Society, which is an internal school organisation for providing apprentices with facilities for any hobby in which they are interested, and always there is a sympathetic specialist at hand to give advice on these hobbies.

There are excellent libraries, both technical and recreational, a large cinema and a well-equipped billiards room. For sports, which are an essential part of the training, there is a large swimming-bath, a fine gymnasium, a golf course and tennis courts, also numerous football and cricket pitches on which games are played with many of the leading public schools.

It is hardly surprising that Halton is often described as the public school of the R.A.F. and that many former aircraft apprentices have achieved Air Rank, among them Air Commodore Frank Whittle.

The way to a man's heart! In spite of rationing, there seems to be no shortage of good food for the aircraft apprentice.

Safer Flying

Fire Risk Greatly Reduced by Henderson Crash-proof Tank

A PHRASE which occurs with distressing frequency in accounts of air crashes is "the machine caught fire and all the occupants were burned." Granted that in a number of cases the crash was so serious that the occupants would have been killed anyway, there must be very many others which were not in themselves so serious that loss of life would have resulted had it not been for the fire.

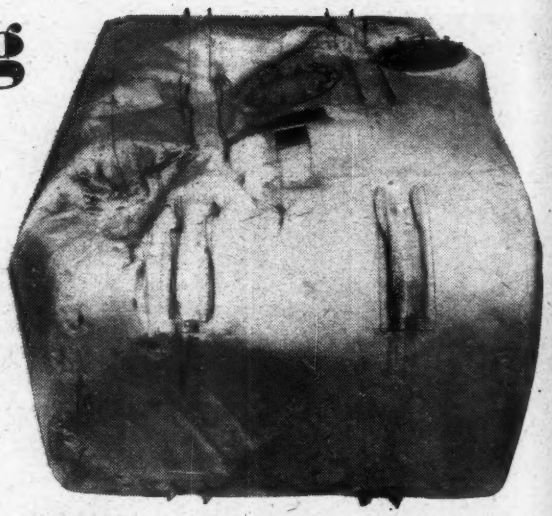
During the war when risks were inevitable, many precautions were taken against fuel fires and leakage. In particular self-sealing tanks, automatic chemical extinguishers and supplies to the tanks of nitrogen under pressure were provided. Now that civil aviation is about to be revived, although such elaborate precautions may not be practicable, it is surely time that serious attention was given to the possibility of reducing the danger of fire in a crash. Apart from the risk to the occupants themselves, there have been many instances of machines hitting people or houses on the ground, and this aspect should not be overlooked.

There has been in existence for several years a type of fuel tank which has been found to give a very substantial measure of protection against fire in crashes which would not otherwise prove fatal to the crew. It is the Henderson crash-proof tank, designed and manufactured by the Henderson Safety Tank Co., Ltd., of Elstree Way, Elstree, Herts.

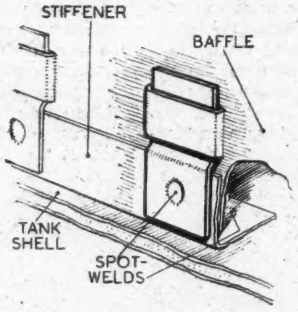
Sandwich Construction

Basically the Henderson tank is a sandwich shell composed of an inner shell of welded construction, an outer shell with folded-seam joints, and a layer of "Hencorite" rubber between the two shells. This construction by itself provides a good degree of protection against rupture in a crash, but it is the combination of the sandwich type of shell with a special method of attaching the internal baffles which makes the tank so effective.

Details of the baffle attachment are shown in a sketch. Stiffeners of L-section are spot-welded to the inner tank shell. The baffles are slotted to receive the special baffle tabs, the lower ends of which are spot-welded to the stiffeners while the upper ends slide in the baffle slots. For normal flying, the spot-weld attachments are sufficient to hold the baffles in place, but in a crash they give way, the tabs pull out of their slots and the baffles come clean away from the main shell, which becomes in effect a "bag" free to deform. The complete absence of riveting prevents the shell from tearing or bursting.



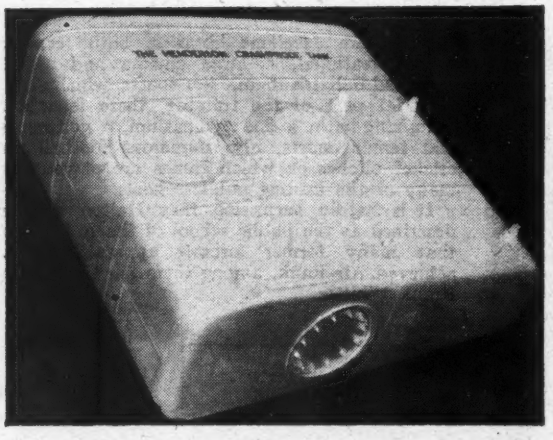
When a Henderson tank is involved in a crash, the baffles come away from the tank shell, which then becomes a "bag" and does not burst at filler caps, inspection openings and attachment fittings.



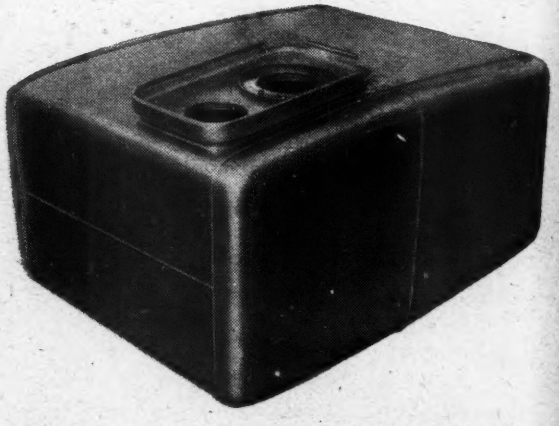
Details of the flexible baffle assembly.

A great number of these tanks have been fitted to Miles Masters and examination of several following crashes showed that although the tanks had been damaged, no leakage had occured even under circumstances that would have caused a standard tank to burst and in none of these instances had fire broken out. An additional advantage of this type of construction is that maintenance is reduced to practically nothing, since the "Hencorite" takes care of

(Concluded at foot of p. 122.)



A tank sent to America for tests. It affords an interesting comparison with the tank on the right, which is of very different proportions.



This tank was built for Captain Lamplugh's Miles M.38. Henderson tanks can be built into any aircraft without modifications to the airframe structure.

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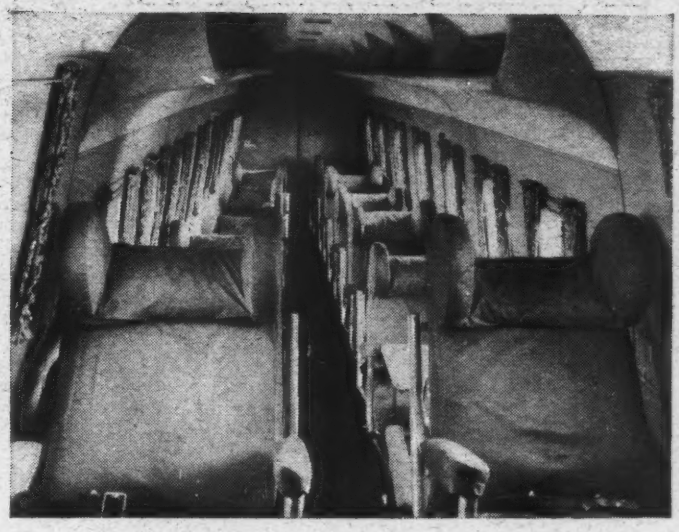


SOUTH AMERICAN LANCASTRIAN: Quite unlike the original long-range V.I.P. Lancastrians are those laid out for British South American Airways. This not very exciting, but nevertheless informative photograph of the interior of a B.S.A.A. Lancastrian shows how the seating is arranged, in normal airline manner.

NEW K.L.M. SERVICES

LAST week K.L.M. opened a daily service between Amsterdam and Zurich in co-operation with Swissair, who are at present making the run three times a week. The Dutch service to Prague is due to be opened on a three-times-weekly basis on February 4, and in due course will start a service to Madrid and Lisbon.

Schiphol, Amsterdam, should see, next month, the first of American Overseas Airlines' Douglas DC-4s on the regular run from New York.

PRESTWICK-BELFAST

A NEW air service between Prestwick and Belfast is being inaugurated by Scottish Aviation. The service will operate four times daily, except Sundays, using 22-seater Dakotas and the single fare is to be 30s.

Announcing this service, Group Capt. D. F. McIntyre said that although the fare would appear to be reasonably low, it was in fact much higher than it should be on account of fuel and other restrictions which limited the use of each aircraft to 60 hours' flying per month.

IN BERMUDA

GENERAL agreement on the question of the use of air bases has been reached by the committee concerned during the conferences in Bermuda. Tentative decisions have been made about the number and positions of those bases which are to be used regularly or as alternatives. The Colonial Governments concerned will, of course, need to be consulted and the report submitted to Washington and London before it is placed in front of the complete conference. Altogether some ten airfields have been under discussion, and the first agreements will probably concern the airfields in Antigua, St. Lucia and at Kindley field in Bermuda.

TWO CHARTER COMPANIES

FIRST of the independent concerns to obtain a foothold at Croydon was the new Morton Air Services, who are operating charter services with a fleet of D.H. Dragon Rapides. The concern actually started operating on January 19 after being in existence for some little time while waiting for the promised freedom. At least two well-known names are associated with M.A.S.—Mr. T. W Morton, who is managing director, and who was, before the war, the chief pilot of Olley Air Service, and Mr. D. L. Eskell, the general manager, who has been concerned in charter work for the last quarter of a century.

Meanwhile, in the North of England, the Lancashire Aircraft Corporation is planning to operate on charter work from the old Stanley Park airfield, Blackpool. Three D.H. Dragon Rapides have been ordered and the company hopes to purchase larger aircraft in due course. The manager is Wing Cdr. B. T. Aikman. During the war the Lancashire Aircraft Corporation has been doing repair work at Blackpool and are, so to speak, merely carrying on from the same base.

THE WAR IN AUSTRALIA

ACCORDING to recent reports it seems likely that the Australian Government may, in an effort to secure airline control, appeal to the country through a referendum. It will be remembered that the airline companies recently appealed successfully against the nationalisation legislation, and obtained a ruling that the Australian Government was not entitled to establish a Government monopoly of internal airlines.

Various suggestions have been made by those who are in favour of nationalisation whereby the private airline operator may be squeezed out. In the meantime, unless the Government can obtain full powers by referendum, it will be necessary for any national airline corporation to launch its own services in competition with those of the existing companies, and the result, from the passengers' point of view, should be magnificent.

THE NEW CORPORATIONS

DRASTIC changes in the board of B.O.A.C. were announced in the House of Lords by the Minister of Civil Aviation on January 23rd.

The new board is composed of ten members—Lord Knollys, Sir Harold Howitt, Sir Harold Hartley, Lord Burghley, Major J. R. McCrindle, Mr. Gerard d'Erlanger, Mr. John Marchbank, Mr. G. M. Garro-Jones, Mr. Clement Wakefield Jones and Major R. H. Thornton. Lord Knollys and Sir Harold Howitt continue as chairman and deputy chairman respectively.

We announced last week the resignation of Brigadier General Critchley from the post of director-general, and now two more members of the former board no longer serve. They are Sir Simon Marks and Mrs. Cusack Fahie, who is better known, perhaps, as Miss Pauline Gower.

During the war years the board was restricted to a maximum number of nine members, but, as Lord Winster pointed out, the necessity for this restriction has now disappeared, and the Order in Council imposing it has, therefore, been revoked.

When the European corporation is formed, Sir Harold Hartley and Mr. d'Erlanger will leave the board of B.O.A.C. and join that of the European corporation, as chairman and chief executive respectively. Until then they will devote themselves at once to the "civilianisation" of R.A.F. Transport Command's existing European services, and to all other matters connected with present and projected services in Europe. The process of taking over European routes from Transport Command is, in fact, already in hand.

The European corporation will also operate the internal network of airlines. It will become a statutory public corporation under the name of British European Airways.

The South American corporation will be officially designated British South American Airways. The entire shareholding of the existing British South American Airways will be bought by B.O.A.C. and the capital for the new corporation will be provided entirely from public funds. As in the case of British European Airways, there will be a completely separate board operating independently of B.O.A.C., and this board will have sole responsibility for the work of B.S.A.A. The chairman of this new corporation is to be Mr. John Booth, who is at present chairman of the Booth Steamship Co., but who severs

CIVIL AVIATION NEWS

his active connection with the shipping world. Air Vice-Marshal D. C. T. Bennett will remain chief executive officer.

The corporations will be subject to the direction of the Minister for Civil Aviation on matters of general policy, and they will be required to use aircraft made by British manufacturers.

We note with interest that the rule of retirement by rotation in accordance with normal commercial practice is to be instituted for all boards formed under the Civil Aviation policy.

The newcomers to the B.O.A.C. board are:

Lord Burghley, who recently resigned the Governorship of Bermuda. He is 40, and was M.P. for Peterborough for twelve years. He was Controller of Aircraft Repairs and Overseas Supplies to the Ministry of Aircraft Production in 1942-3, though he will undoubtedly be remembered more easily as an Olympic Games hurdler.

Major McCrindle, a last-war pilot, was formerly managing director of British Airways and has been deputy director-general of B.O.A.C. for the past five years.

Mr. Garro-Jones is 50, a barrister, and former M.P. for North Aberdeen. He is chairman of the new Television Advisory Committee, and during the war was chairman of the Radio Production Planning Committee and also of the Raw Materials and Central Priorities Committees.

Mr. Wakefield Jones, 65, is a director of Alfred Booth and Co., Ltd., the Booth Steamship Company, and the Sea Insurance Company.

Major R. H. Thornton is a keen amateur pilot and a member of a Liverpool shipping firm.

THE FRENCH ATLANTIC

THE Paris-New York service of Air France, operating through the Shannon Airport, is expected to start in April, using Lockheed Constellations. At the same time Air France hopes to operate a Dublin-Paris service, in co-operation with Aer Lingus Teoranta, during this summer.

A PROSPECTIVE MARKET

AERO OY, Finnish Air Lines, who restarted flying on internal services on August 13, are now operating between the more important cities of Western and Northern Finland. The operational centre is Hyvinkää airport, about 35 miles north of Helsinki. Discussions on nationalisation are proceeding, but nothing has yet been officially decided.

At the moment lack of aircraft prevents any considerable expansion. The present equipment of Aero OY consists of two Douglas DC-2s, two Ju 52s, and one D.H. Rapide. But, as a result of the war, there are good ground facilities all over Finland.

GEOGRAPHICALLY SPEAKING

BRITAIN would be less likely to lose her place in world aviation if foreign-built aircraft were used now to extend British airlines all over the world, instead of withholding full entry into air commerce until we could use exclusively all-British-built aircraft. This was one of the points stressed by Group Capt. D. F. McIntyre, of Scottish Aviation, when he addressed the Glasgow branch of the Royal Scottish Geographical Society on January 19.

He suggested that Scotland had a tremendous geographical advantage in air commerce, for the northern hemisphere contained 90 per cent. of the world's population and, in this hemisphere, the more northerly the route, the shorter was the trip. As an example, he quoted the trans-ocean hop to America as being 250 miles shorter from Prestwick than from London.

Group Capt. McIntyre foreshadowed the use of 360-seater aircraft on the Atlantic route at fares below the level of third-class "surface" passenger fares, each aircraft cruising at 340 m.p.h. and carrying an annual total of over 100,000 passengers in 300 single journeys between Britain and America. He added that such a 360-seater aircraft was already at the last stage of its test flights. By comparison, he said that the *Queen Mary*, which accommodated 2,000 passengers, could make, at most, 26 single journeys and carried only a total of 50,000 passengers each year.

From these figures, Group Capt. McIntyre deduced that one aircraft such as he described would provide a frequency of service more than ten times greater than that of the *Queen Mary* at a fraction of the capital cost. This, however, seems to us to be expecting rather a lot from one aircraft.

GLIDING FOR BRISTOL

IN preparation for a resumption of activities in due course, a general meeting of the Bristol Gliding Club will be held in the near future. Meanwhile, a new "register" of members is being built up, and those interested are invited to write to the Secretary at 9, Royal Park, Clifton, Bristol, mentioning any previous flying or gliding experience.

ROLLASONS AGAIN

YET another reminder that the war is really over has been the return of so many pre-war names to the civil aviation "industry." The latest is that of W. A. Rollason, who has returned, with a firm of that name, to the work of aircraft service, sales and repairs, with a main office at Terminal House, Grosvenor Gardens, London, S.W.1, and a factory at an airfield which will be named later. With him, as sales manager, is Mr. E. W. ("Jock") Bonar.

Grp. Capt. Rollason has, during the war, been with 43 Group, Maintenance Command, and the Aeronautical Inspection Department. He was the founder of the Rollason Aircraft Service Organisation and was a transport pilot previous to 1929.

Mr. E. W. Bonar has flown professionally since leaving the R.A.F. in 1929 and, for the past three years, has been chief test pilot for Napiers.

GLIDER C. OF A.s

SINCE the British Gliding Association's inspection organisation has been largely dispersed, arrangements have been made for the Air Registration Board to act as the Association's technical advisors in the issue and renewal of C. of A.s. It is anticipated that, in the post-war Air Navigation Regulations which are now being prepared, gliders will be officially recognised as "aircraft." The A.R.B. will then act as advisors to the Ministry of Civil Aviation on glider design and construction.

Before the war there was no provision under the Air Navigation Acts for the certification of gliders, but the B.G.A. technical committee did, in fact, issue unofficial C. of A.s after the designs had been approved. The technical committee will continue to work closely with the A.R.B., and one of its members, Mr. H. E. Bolton, has joined the staff on part-time basis.

LIGHT AIRCRAFT CONFERENCE

WHILE matters of international moment in civil aviation were being decided in Bermuda, a group of enthusiasts at Harrogate were discussing the future of the ultra-light aircraft. The Aircraft Club considered a number of points relating to the future of private flying and gliding.

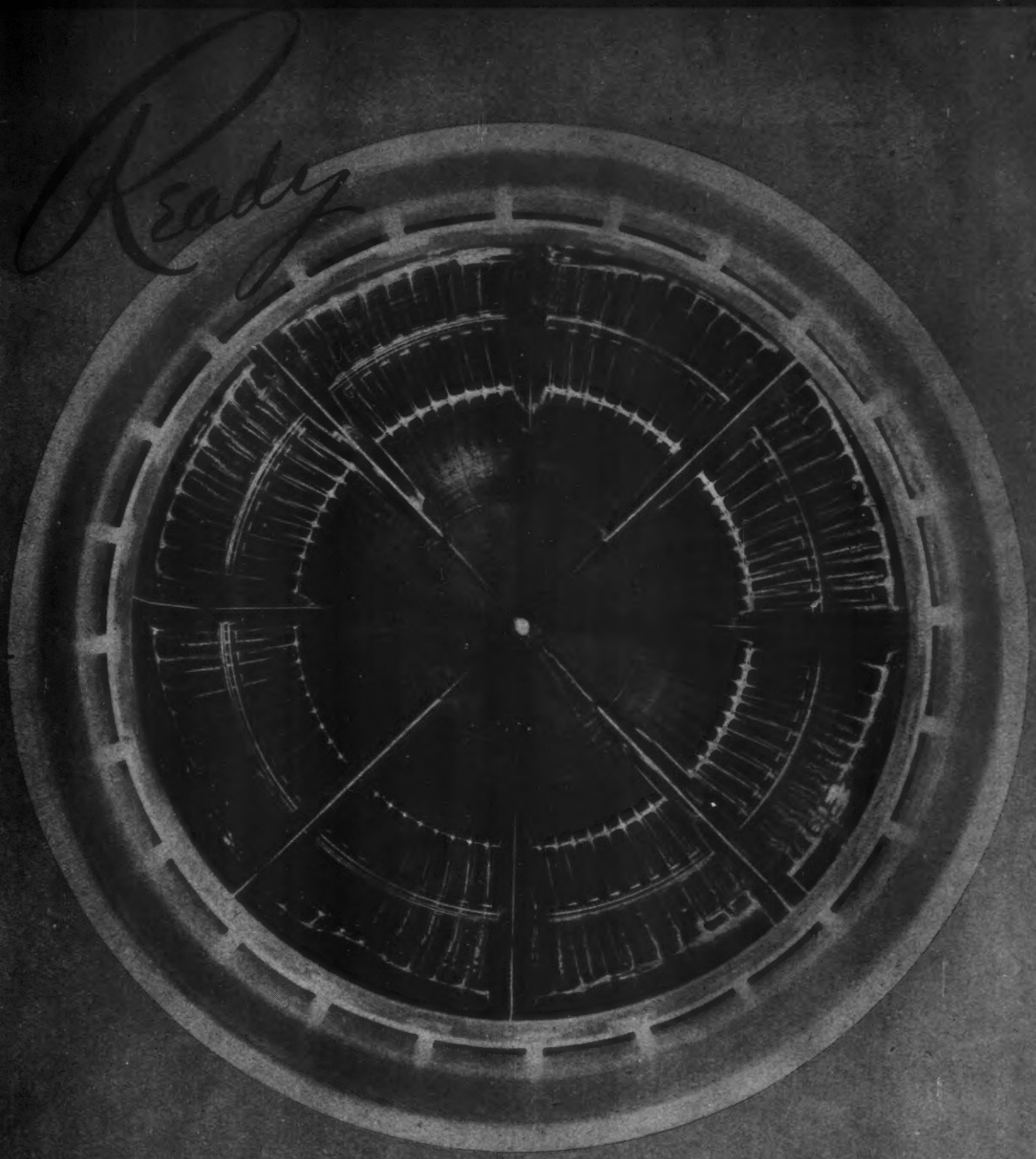
It was generally recommended that a chain of small landing fields near centres of the population should be established for the use of small aircraft, each field to be 400 yards square, with a minimum of 200 yards square, and, as far as possible, in a standard position on the west side of the towns. Provided that the approaches were unobstructed, the sizes recommended were considered to be ample for the purpose. It was suggested that designers should go back in thought as far as the 1923 and 1924 Lympne trials and then develop new types with modern improvements, using, if necessary, modified motor cycle or similar power units. It was suggested that all ultra-light aircraft flying should be preceded by a course of training on gliders.

Safer Flying

(*Continued from page 120*)

vibration. Installation presents no difficulty since the tanks can be fitted in the space occupied by the normal tanks without structural alterations. Last week we illustrated a Henderson tank in the Desford Trainer. Two other shapes are shown on p. 120.

That a price has to be paid for all these advantages is obvious. It is not a heavy one. A 30-gallon tank weighs about 30 lb. This may be double the weight of a normal tank, but is certainly not prohibitive. The cost, too, is necessarily greater, but since the British Aviation Insurance Co., for instance, is prepared to give special consideration to aircraft fitted with this type of tank, the extra cost should soon be recovered in lower premiums. The comfortable feeling that even in a fairly bad crash there is unlikely to be a fire should be worth a great deal to future owners of small and medium-size aircraft.



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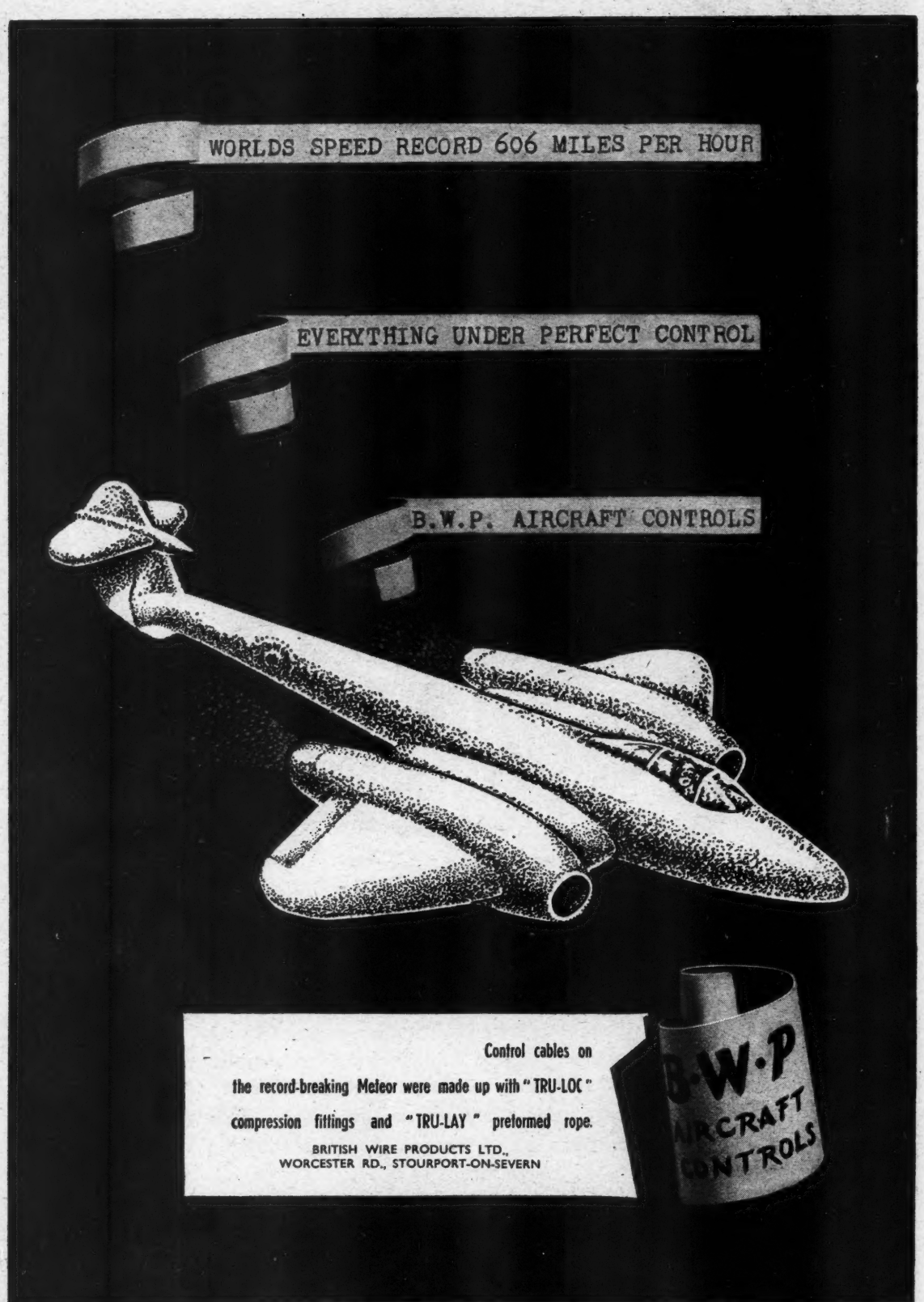

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Coastal Command's Own War

Part I—From First to Last on Active Operations : How the U-Boats Were Hunted

By MAJOR F. A. de V. ROBERTSON, V.D.

FROM September 3rd, 1939, to May 10th, 1940, the second world war was known to the wags as a "phoney war." The Air Ministry held regular Press conferences during that time, and the distinguished officer who used to preside would explain, almost apologetically, to the assembled journalists that Bomber Command was dropping leaflets, that Fighter Command was ramping up and down the coasts in a state of frustrated irritation, and that only Coastal Command could really provide the newspaper men with any stories. Likewise after VE day Bomber and Fighter Command ceased to slay their opponents, but Coastal Command had to carry on its work until it was certain that every U-boat had received the orders of Admiral Dönitz to stop fighting. No losses are so tragic as those incurred after a war is over.

In between those two memorable dates Coastal Command rather faded out of the news, and the Air Ministry spokesman grew almost apologetic that he could find so little to say about its doings, compared with the exploits of the bombers and fighters. The fact that it was the first and also the last R.A.F. Command to be engaged in active operations is sufficient proof that its activities in between the outbreak of war and the victorious conclusion were not wholly devoid of interest. Probably the majority of sorties had nothing to report, but when an enemy was sighted there was plenty of excitement.

It must be obvious to everyone that, quite apart from the possibilities connected with the atomic bomb, air warfare had not reached its ultimate possible stage by 1945. There have been many developments during the six years of warfare, and there are bound to be more in the future. But there has always been (and presumably will always be) one duty which aircraft will have to undertake, and that is reconnaissance. That was the first duty allotted to them in 1914, and it is equally important to-day. So from the moment that war came upon the world in 1939, the aircraft of Coastal Command had to start scouring the seas round the coasts of the British Isles to see that the ships of the Merchant Navy could proceed on their lawful occasions without interference. Later on the Command developed into a formidable striking force; but its first business was to look and see. When it became aggressive its duties fell into two parts, strikes against U-boats and strikes against enemy shipping. Each of these two roles makes a thrilling story, and it is best to tell them separately. We will take the campaign against U-boats first.

A Handicapped Start

By the end of the war Coastal Command could boast the possession of more aircraft and more men than the whole R.A.F. owned in 1939; but at the outbreak of hostilities the Command was far from being adequately equipped for its exacting tasks. It had five squadrons of flying boats, equipped with obsolescent Londons and Stranraers and a few Sunderlands. The Sunderland, by the way, never was regarded as obsolete or obsolescent during the war, even though its top speed was not more than 210 m.p.h. It was not until March, 1941, that the Command received its first Catalina. At the beginning it also had eight squadrons of Ansons, a type which had a range of 600 miles and could carry two 1,000 lb. bombs. There was one squadron of Hudsons. In course of time all the Anson squadrons were re-equipped with Hudsons. There were also two squadrons of torpedo-bombers, but the Vildebeests, though good load-carriers, had not the range to make them very useful. Next year the Command received Beaufighters, and then the torpedo began to shine as a very useful weapon. Aircraft used the 18-inch torpedo. Altogether Coastal Command started the war with only 171 aircraft. In the early days it sometimes used little Tiger Moth trainers to help out the exiguous supply of first-line aircraft. They could not strike, but they could look and see.

Despite all its shortcomings in the way of equipment, the Command did very well even in the earliest days of the war. The U-boat commanders were inexperienced in attacking in the face of air and surface escorts, and by the end of 1939 there had been 64 sightings and 49 attacks. It was often impossible to decide whether an attack with bombs had actually resulted in the destruction of a U-boat.

In 1940, when France had been overrun by the Germans, the U-boats made their chief bases in the ports of the Bay of Biscay, and that meant that the Battle of the Atlantic had begun in earnest. As Mr. Churchill constantly reminded the country, this was the most crucial of all our struggles, at least after the Battle of Britain was over. In 1917 the Germans, by means of their U-boats, had nearly starved us into surrender. In 1940 they tried again to do so. Had they been able to sink enough of our shipping they might have succeeded. It was for the Royal Navy and Coastal Command to see that they did not succeed.

Sir Frederick's "Secret Weapon"

Before we pass on to the second chapter in the history of the Command we should pay due respects to the gallant protagonists. Every day a patrol had to be flown from north Scotland to the limits of Norwegian waters—Norway was then a neutral. The object was to see if either U-boats or surface ships were trying to break out from the North Sea into the Atlantic. Often the weather was too foul for the observers to see anything, and it was probably due to that circumstance that H.M.S. *Rawalpindi* was sunk, probably by the *Scharnhorst*. Most of these northern patrols were carried out by Ansons. But bad weather was often a protection to the Ansons, which could hide in the clouds. Nevertheless they were not infrequently attacked by Me 109s. The Anson was certainly never designed as a fighter (originally it was a civil transport machine) but it could, of course, "turn inside" the German fighter and it did not always come off worst in these encounters. In fact, Air Chief Marshal Sir Frederick Bowhill once jokingly called the fighting Anson his "secret weapon."

By the winter of 1940-41 the resources of Coastal Command had grown. There were more Sunderlands—and the heavily armed Sunderland proved a very prickly customer for German fighters to tackle. Hudsons were by then in general use, and there were some squadrons of Whitleys and Wellingtons. By August, 1940, there were squadrons in Iceland and a new Group was formed at Liverpool. Radar, though in rather elementary form, was by then in use on aircraft, and depth charges were adapted for carriage by air. The Amatol depth charge which was used at first was found to be not powerful enough. It was more prone to damage than to kill; but a more powerful explosive, Torpex, was presently substituted. Aircraft were recognised as an offensive weapon. It was no longer merely a reconnaissance scout.

New tactics were then adopted. Though air escort was provided when a convoy appeared to be in danger, routine defensive escorts were left to surface craft of the Royal Navy. The story of the corvettes and frigates is a romance by itself; but here we are concerned with the tactics of Coastal Command. Its aircraft now concentrated on attacking the U-boats in their transit areas, as they were called. The Bay of Biscay was one of the most important, and another was called the Northern Transit Area, namely, the seas between Norway and Iceland. A regular air offensive

COASTAL COMMAND'S OWN WAR

was launched in May, 1941, and the losses among our shipping at once fell steeply. It was at that time rare for a ship to be sunk within 450 miles of a Coastal base. In August of that year a damaged U-boat surrendered to a Hudson.

The next move in the game was the sending out by the Germans of F.W. Condors. They would attack our ships with bombs when they found an opportunity; but their most important business was to find our convoys and pass on the information to the U-boat "wolf-packs." We replied with special patrols of Hudsons, and afterwards of Beaufighters. The Condors were very unwilling to fight. Fighting is never the business of a scout if he can avoid it. Moreover, if the British aircraft was damaged, the crew had a chance of being rescued by one of the ships; but a badly damaged Condor had a very poor chance of getting its crew safe home.

Then the Admiralty fixed catapults on merchant vessels, and sent Hurricanes out to tackle the Condors. It was expensive, for the Hurricanes were bound to end up in the sea, and the pilots could not always be picked up. But the Condors naturally had a wholesome dread of these eight-gun fighters, and were still more discouraged. Then came the escort carriers, and by the end of 1941 the Condor threat had been virtually defeated.

By December, 1941, the United States was a belligerent and an Ally. That rendered their ships liable to attack without any breach of law by the Germans; and at first the Americans were inexperienced in dealing with U-boats. The latter went across the Atlantic, taking their time, and at first they enjoyed good hunting. Those good times did not last long. British experience was placed at the disposal of the Americans, and they were quick to learn.

Radar and Searchlights

By May, 1942, Coastal Command had Wellingtons equipped with radar and searchlights, and it sent them out over the Bay of Biscay, hunting by night as well as by day. The Germans in 1943 reversed their tactics, and instructed their captains not to seek safety by diving, but to remain on the surface and fight it out with their guns. They had armed their U-boats more heavily. The new tactics were not a success. The number of sightings, of course, went up dramatically, and the Wellington crews declined to be intimidated by the gunfire. By that time the Command had 31 squadrons (plus an American squadron in Iceland) engaged in anti-U-boat patrols, and in three months they sank 43 of the U-boats, and shared with the Navy in two more, but had lost 42 aircraft. In time of war one becomes cold-blooded in working out the arithmetic of gains and losses; and when one considers the harm that 43 U-boats might have done in sinking ships, killing seamen, and depriving Britain of much-needed commodities, one has to admit that the loss of 42 aircraft was a cheap price to pay, tragic though the loss of aircrews undoubtedly was. The overriding consideration was that the Battle of the Atlantic was Britain's life and death struggle, and no loss could be counted too heavy which made for success in that fight. In just over three months the number of U-boats at large in the Atlantic was reduced by about half, and our shipping losses had sunk to an almost negligible figure.

All this time a fight between the German and British scientists had been going on. The Germans provided their boats with search receivers to detect the radar on an approaching British aircraft. In due course the British scientists developed a new form of radar which was not detectable by the search receivers. The Torpex depth charge replaced the Amatol, with satisfactory results. It was American scientists (as the Admiralty has recently admitted) who produced the Sono Buoy, which was dropped by searching aircraft. It had a hydrophone and a radio transmitter installed in it, and the crews in the aircraft could listen to the U-boats under the water, and could attack them unseen. Clever as the enemy scientists are, the Allies were always a point or two ahead of the Germans.

In November, 1942, the Allied landings in N.W. Africa called for a special effort by Coastal Command. It was reinforced by Bomber Command and by the U.S. Army Air Forces. Looking back it seems incredible that such a vast fleet of warships and transports should assemble off a hostile coast and effect a successful landing without suffering very heavy losses from the opposing fleet of submarines. But so expert at its job was Coastal Command by this time, and so efficient the whole organisation, that during the operation only one merchant vessel was damaged by a U-boat.

For a while in 1943 there was a lull in the Atlantic. The U-boat captains had been impressed by their losses, and were unduly cautious. Then the permission granted by Portugal to the British to use the Azores as a base further restricted the liberties of the U-boats. Coastal formed a new Group in the Azores. Then the balance sank the other way. The Germans put into use an improved search receiver which could detect our A.S.V. (anti-surface vessel radar). The Schnorkel device, which enabled a U-boat to "breathe" while still submerged, was given high priority by German armament manufacturers. The new boats also had a higher speed when submerged. On the other hand, some Coastal Mosquitoes were equipped with six-pounder guns and some Hudsons with R.P. (rocket projectiles). The U-boats from Norway were ordered to move to the Biscay ports, and the fight ranged all over the seas from Scotland to the Arctic. Very few of the boats reached the Bay.

Once more we must turn to the middle of the Atlantic. The escort carriers had done much to close the gap in the centre which had hitherto been out of range of aircraft based in either Britain or North America; but still more measures were needed. In 1942 the V.L.R. (very long range) Liberators appeared on the scene. By removing defensive armament and fitting extra fuel tanks these machines were given a range of 2,300 sea miles. The Americans and Canadians sent them off from Newfoundland, and they broke up the wolf packs. At last the "gap" had been satisfactorily closed. The greatest problem of the Atlantic battle had been solved.

And Then the Invasion

In June, 1944, came the longed-for invasion of the Continent from the West. Coastal Command had been practising its part. Once again there would be an enormous congregation of ships of all sorts and sizes, offering a most tempting bait to submarine captains. The small ships of the Navy and the aircraft of Coastal Command were given the task of keeping the enemy at a distance. Of course the boats from Biscay and those from the Norwegian ports were ordered to make for the English Channel in full force. Air Chief Marshal Sir Sholto Douglas laid a barrier of patrols across the approaches to the Channel by day and night. The aircraft were thoroughly accustomed to work with the small ships of the Navy, and to summon their assistance when a U-boat was spotted. The Leigh light helped such aircraft as had been fitted with it to make good shooting by night. No single assault ship was sunk by a U-boat. The losses of the enemy were heavy. By the end of July the threat to our invasion had been beaten.

As the German armies were driven back towards the Rhine there was much coming and going between Germany and Norway. German troops were brought south, and supplies for those left behind were sent northwards. This gave a chance to the Halifax bombers of Coastal, and they worked indefatigably over the Skagerrak and Kattegat. It was almost the last phase.

In the five and a half years of warfare Coastal Command, helped by the Dominions and Allies, and by the Fleet Air Arm, sighted 2,557 U-boats and attacked 1,664. How many of those were destroyed may ultimately be ascertained from the German records. In any case Coastal Command made a tremendous and untiring effort, and, in conjunction with the Royal Navy, it won its own war.

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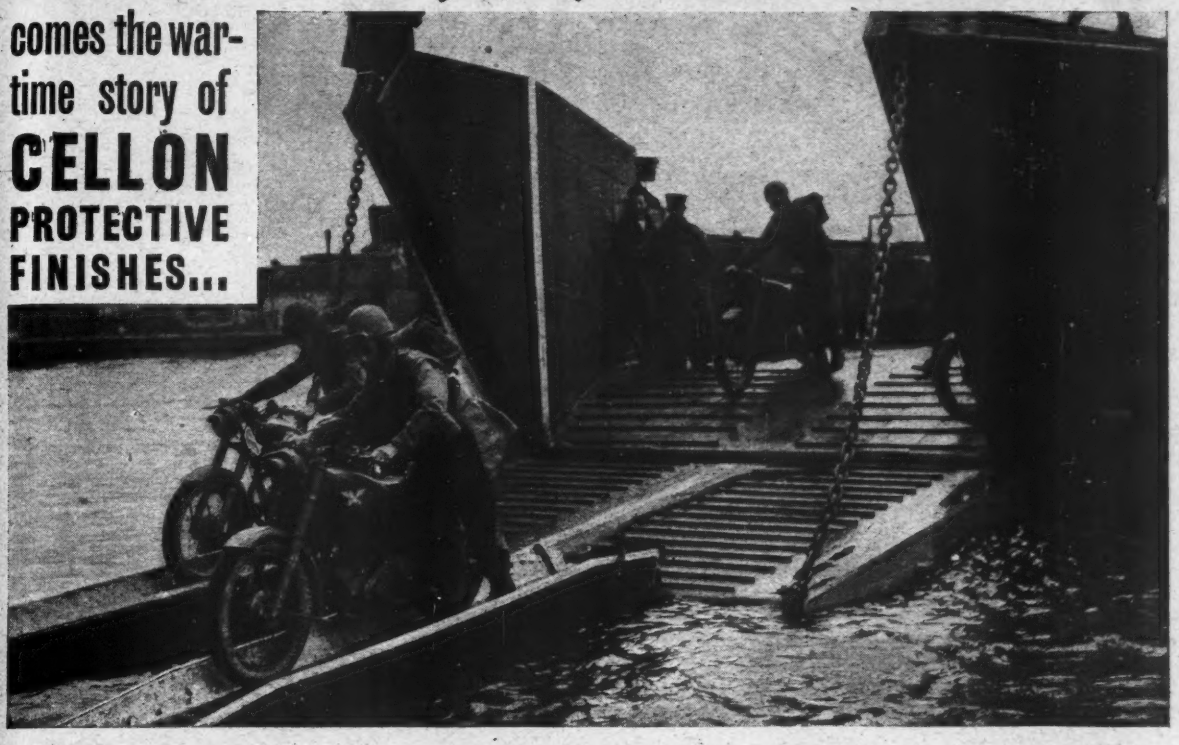

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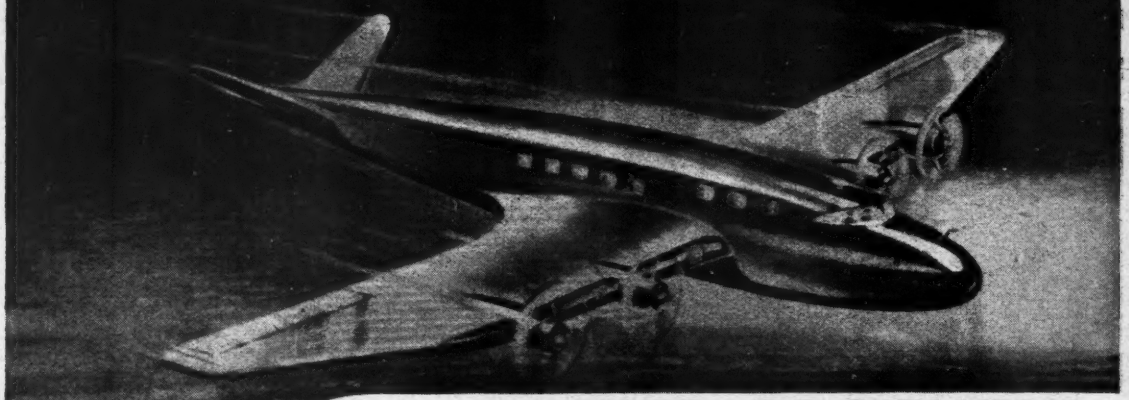

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HEATHROW
Out-of-wind Landings

IN a recent statement in the Press, in connection with Heathrow airport, it was stated that large aircraft would not be able to land when the wind was northerly owing to the runways being too far out of wind, because large aircraft are much more difficult to land in a cross wind than small aircraft.

For two reasons I consider this statement to be false.

(1) In the case of a heavy aircraft and a light aircraft approaching to land at the same speed, the heavier aircraft will be easier to land owing to its extra inertia obtained from greater weight, which would tend to make the aircraft continue along its landing path after touching down, providing of course that drift has been correctly neutralised by use of rudder immediately prior to touching down.

(2) In the case of a heavy aircraft approaching at a higher speed than a light aircraft, the heavy aircraft will obviously have less drift than the light aircraft, and consequently be easier to land.

Perhaps one of your correspondents could confirm the above statements. PUZZLED.

BRITISH AIRLINES
Should Not Have to Use U.S. Machines

I WAS horrified the other day to see in the paper that we were considering buying American aircraft for our civil airlines. What is wrong with our own aircraft?

In the Tudor I, York, Lancastrian, Sandringham, Seaford and Viking we have aircraft to operate services in Europe and throughout the world and well able to hold their own against any American services. It is also up to the Powers-That-Be to place orders, now, for such aircraft as the Shetland, Tudor II, Hermes, Wayfarer and Freighter, and to give the firms all possible help to get the aircraft into production and put them into service at once.

For one example, look how the Shetland has been hanging about! She was first heard of, I believe, at the beginning of 1945 or before, and she has not gone into service yet, although she is probably the best civil flying-boat yet produced by any country.

I also think it is about time Transport Command gave up carrying civilian passengers and handed over their routes in Europe to B.O.A.C., or we shall find the Americans in on the European routes before us. R. J. HITCHMAN.

LIGHT AIRCRAFT
A Low-powered Engine Needed

I DO not think it is premature to talk about private flying on light aircraft, although the authorities seem in no great hurry to release airfields, or aid with other facilities, or even to make a statement of policy for the future.

There have been in the flying journals a number of articles on the ideal light aircraft, all of which, in my opinion, are on the ambitious side for the average private owner, although well suited for club work. A cost of about £1,000 and an engine of 100 h.p. are too much and too large.

It seems that the engine is the main problem, from the point of view of price if nothing else. With our present knowledge of materials, wood and metal, particularly impregnated and compressed woods, it should be possible to produce small two-seater monoplanes with very low structural weight and excellent finish, to have a performance equivalent to pre-war aircraft, but with about two-thirds or less of the engine power. Tipsy, Chilton and certain other light pre-war aircraft come to mind as approximating to my specification, which calls for a speed of about 100 m.p.h., an initial climb of not less than 600 ft./min., an engine of about 45 h.p. output, and a cost of not more than £500.

While fully realising the difficulties—C. of A. and the like—I still think there will be some room, too, for home construction from semi-finished component parts, there being even more reason for this now that labour costs represent such a high proportion of the total price of aircraft.

May I finish by pointing out that we make the best large and intermediate aircraft engines in the world (i.e., we know the answers), and we have for many years made the best motor cycle and small car engines. We also have the plant facilities, so why will not a few reputable engine manufacturers design and produce, say, one aircraft engine of about 45 h.p., or a range of engines from 30 to 75 h.p., weighing not more than 2½ lb. per h.p., and at a price bearing some relationship to the motor cycle or small car counterpart? If you are depending upon one little engine, it needs to be a good one.

Quite apart from our own needs, I feel sure that there would be an immediate and sizeable demand for such engines in the Dominions, Europe, South America and even the U.S.A. At the moment this world market is open; cannot Britain step in?

IMPECUNIAVIATOR.

HALIFAX PROTOTYPES
The Test Pilot on Maiden Flights

AS a constant reader of *Flight* I write to express surprise that no one has yet corrected a mis-statement of facts, which might well be the cause of unpleasantness and suspicion.

In the article in *Flight* of December 6th concerning the Hermes crash, you stated that Flt. Lt. Talbot had carried out the maiden flights on Halifax prototypes, and I feel sure Flt. Lt. Talbot would have been the first to ask you to correct this statement.

Maiden flights of the first and second prototype Halifax aircraft were carried out in October, 1939, and August, 1940. Flt. Lt. Talbot made his first solo flight in a Halifax in mid-September, 1940, and although he flew as second pilot for some time, he did not begin testing production Halifax aircraft until late in February, 1941. Up to that time, all maiden flights, and most of the production testing, was done by Major J. L. B. H. Cordes. MARTLESHAM.

[Our apologies to Major Cordes. During the war there was a considerable "security" time-lag between the first flights of a new aircraft type and the first publication of pictures, etc. At the christening by Lord Halifax at Radlett, in September, 1941, the machine was piloted by Mr. Talbot, and it was evidently this recollection which was in the writer's mind.—ED.]

FUTURE OF THE A.T.C.
A More Imaginative Policy Needed

FLIGHT'S understanding attitude towards the problems of the A.T.C. has prompted me to write and air some of the grievances held by members of the Corps.

During the war many tributes were paid to the A.T.C., and it was promised that it should continue to function in peacetime with many added facilities for training. But numbers continue to dwindle because there is not enough interest in the A.T.C. training programme. There has been no reorganisation of plans since the war ended; in fact, there is so little evidence of any official interest in the Corps that the A.T.C. might well have ceased to exist!

In my own squadron, for example, we attend two evenings every week and learn navigation, morse and maths exactly as we have done for the last three years. Every Sunday we practise drill and P.T. Twice a year we visit a nearby airfield and are treated to ten minutes' flying in Tiger Moths. The one really bright spot of the whole year is camp, when the R.A.F. are usually good enough to give us a really interesting week.

From the foregoing it must surely be seen that far more drive and initiative in planning the A.T.C. syllabus are needed at the Air Ministry. My suggestions for increasing the numbers, and the keenness, of the A.T.C. are as follows:—

(a) Make available to A.T.C. units such items of equipment as Link Trainers, surplus R.A.F. navigational and wireless apparatus, and similar equipment.

(b) Replace some of the theoretical training by more interesting practical work, organised visits to R.A.F. stations, and instruction in driving. (Flying lessons would be too much to expect.)

(c) Issue cadets with battledress to replace the present style of uniform, which has always been unpopular. (University squadrons of the A.T.C. receive both greatcoats and battledress!)

In short, let the Powers-That-Be regard and treat the A.T.C. as a junior branch of the R.A.F. The results would certainly be worth the effort. CANDID CADET.

"Flight" photograph.

HOLLAND'S CHOICE: A line-up of the first batch of Fairey Fireflies ordered by the Dutch Government. They will form the equipment of No. 860 Squadron of the Dutch Naval Air Arm.

SERVICE AVIATION

Royal Air Force and Naval Air Arm News and Announcements

Appointments

Royal Air Force

AIR VICE-MARSHAL SIR HUGH PUGHE LLOYD, K.B.E., C.B., M.C., D.F.C., to be R.A.F. Instructor (Designate) at the Imperial Defence College.

Air Vice-Marshal Alick Charles STEVENS, C.B., to be Air Officer Commanding No. 4 Group, Transport Command.

Air Vice-Marshal Sir Hugh Lloyd was appointed A.O.C. Very Long Range Bomber Force in April, 1945, having been A.O.C. Planning Force, for V.L.R. Bomber Force. This force was known by the name "Tiger Force," and was to have joined in the attack on Japanese war potential from bases in the Ryukyu Islands, of which Okinawa was the best known. The latest types of R.A.F. bombers and missiles were to be used.

Sir Hugh Lloyd was A.O.C. of the North-West Africa Coastal Air Forces from March, 1943, to November, 1944, and while in that post organised the air escort operation covering the Salerno landings. He was previously S.A.S.O. to Sir Arthur Tedder at H.Q. R.A.F. Middle East, and from May, 1941, was A.O.C., R.A.F., Malta, at the height of the enemy attempts to neutralise the island as an offensive base. For his work in this Command Sir Hugh received the C.B. and K.B.E., and a congratulatory message from the Secretary of State for Air spoke of his "brilliant leadership."

Air Vice-Marshal Stevens has been A.O.C. No. 47 Group since August, 1945. In June, 1944, he was appointed A.O.C., Gibraltar, having previously been S.A.S.O. No. 18 Group (Coastal Command). From 1940 to 1943 he was Deputy Director of Naval Co-operation, Air Ministry.

Air Vice-Marshal Stevens' new command, No. 4 Group, formerly a Group in Bomber Command, is now responsible for all training within Transport Command.

Aircrews are chosen for Transport Command at R.A.F. Station, Snaith, Yorkshire, a former Bomber Command station now transferred to No. 4 Group. Before a pilot is permitted to fly passengers in four-engined Liberators or Yorks, he must have a minimum of 1,000 hours' flying, 200 of them on multi-engine aircraft. Pilots with less experience are chosen for Dakota squadrons supplying ground forces.

Future pilots of four-engine transports go to Dishforth in Yorkshire for a course at a heavy conversion unit. Throughout their training the comfort of passengers is stressed as being of paramount importance. After passing the stiff examination at the end of the course aircrews normally do two or three freight-carrying trips before being allowed to fly passengers

Promotions

AIR CDRES. (hon.) to be Air Vice-Marshals. Hon. Col. His Highness Raj Rajeshwar Maharajadhiraja Sir UMAID SINGHJI BAHADUR, G.C.S.I., G.C.I.E., K.C.V.O., A.D.C., Maharaja of Jodhpur. Hon. Col His Highness Iftikhar-ul-Mulk Sikandar Saulat Nawab Haji Sir MUHAMMAD HAMIDULLA KHAN BAHADUR, G.C.S.I., G.C.I.E., C.V.O., Nawab of Bhopal.

Awards

THE KING has been graciously pleased to approve the following awards in recognition of gallantry and devotion to duty in the execution of air operations:—

Distinguished Service Order

Act. Sqn. Ldr. L. C. C. HAWKINS, D.F.C., R.A.F.V.R. No. 135 Sqn.—This officer has a distinguished record of operational flying. During the Burma campaign he has led numerous army support and long range tactical bombing missions during which he has himself destroyed at least two Japanese aircraft and inflicted considerable damage on the enemy's motor transport vehicles, river craft, locomotives and rolling stock. Sqn. Ldr. Hawkins is a magnificent leader who has consistently displayed outstanding courage and determination which, coupled with his fine fighting spirit, have been a source of inspiration to the other members of the squadron he commands

Badge of No. 83 Squadron, Royal Air Force—"Strike to Defend."

Badge of No. 695 Squadron, Royal Air Force—"We Exercise Their Arms."

Bar to Distinguished Flying Cross

Act. Sqn. Ldr. L. S. THORPE, D.F.C., D.F.M., R.A.F.V.R., No. 35 Sqn.

Act. Sqn. Ldr. M. F. WHITE, D.F.C., R.A.F.V.R., No. 7 Sqn.

Flt. Lt. A. A. BOWLEY, D.F.C., R.A.F.V.R., No. 109 Sqn.

Flt. Lt. P. P. MATHER, D.F.C., R.A.F.V.R., No. 7 Sqn.

Flt. Lt. H. C. WRIGHT, D.F.C., R.A.F.V.R., No. 35 Sqn.

Act. Flt. Lt. J. A. R. CARRAD, D.F.C., R.A.F.V.R., No. 156 Sqn.

Act. Flt. Lt. E. J. RIGBY, D.F.C., R.A.F.V.R., No. 35 Sqn.

Act. Flt. Lt. S. A. R. TAYLOR, D.F.C., D.F.M., R.A.F.V.R., No. 7 Sqn.

Act. Flt. Lt. S. TURNER, D.F.C., R.A.F., No. 35 Sqn.

F/O. V. E. AZZARO, D.F.C., R.A.F., No. 7 Sqn.

F/O. W. C. BRIDGFORD, D.F.C., R.A.F.V.R., No. 109 Sqn.

F/O. J. E. BROWN, D.F.C., R.A.F.V.R., No. 582 Sqn.

F/O. R. V. DICKESON, D.F.C., R.A.F.V.R., No. 156 Sqn.

F/O. F. MARSHALL, D.F.C., R.A.F.V.R., No. 7 Sqn.

F/O J. A. MCCOLLAH, D.F.C., R.A.F.V.R., No. 7 Sqn.

F/O. L. J. SALTMARSH, D.F.C., R.A.F.V.R., No. 7 Sqn.

F/O. A. R. WRAY, D.F.C., R.A.F.V.R.

P/O. H. G. HUDSON, D.F.C., R.A.F.V.R., No. 7 Sqn.

W/O. J. EGAN, D.F.C., R.A.F.V.R., No. 156 Sqn.

Act. Sqn. Ldr. L. L. MCLEOD, D.F.C., R.A.A.F., No. 405 (R.C.A.F.) Sqn.

Act. Sqn. Ldr. K. A. RAWSON, D.F.C., R.A.A.F., No. 7 Sqn.

Act. Sqn. Ldr. T. N. SCHOLEFIELD, D.F.C., R.A.A.F., No. 97 Sqn.

Act. Flt. Lt. J. R MACL. MORRISON, D.F.C. R.A.A.F., No. 7 Sqn.

F/O. T. G. BUNCE, D.F.C., R.A.A.F., No. 7 Sqn

Act. Flt. Lt. F. L BOYD, D.F.C., R.C.A.F., No. 635 Sqn.

Act. Flt. Lt. M S. KYTE, D.F.C., R.C.A.F., No 405 (R.C.A.F.) Sqn.

Sqn. Ldr. G. M. ALLCOCK. D.F.C., R.A.F.O., No 7 Sqn.

Act. Sqn. Ldr. W. BAKER, D.F.C., R.A.F., No. 105 Sqn.

Act. Sqn. Ldr. N. BOWMAN, D.S.O., D.F.C. R.A.F.V.R., No. 109 Sqn.

Act. Sqn. Ldr. M. E. H DAWSON, D.F.C., D.F.M. R.A.F.V.R., No. 7 Sqn.

Act. Sqn. Ldr. K. E. FRANCIS, D.F.C., R.A.F.V.R. No. 109 Sqn.

Act. Sqn. Ldr E. M. SLEEP, D.F.C., R.A.F.V.R. No. 109 Sqn.

Act. Sqn. Ldr. S. R. STANBRIDGE, D.F.C., R.A.F.V.R., No. 128 Sqn.
Act. Sqn. Ldr. D. A. WATSON, D.F.C., R.A.F.V.R., No. 109 Sqn.
Flt. Lt. A. ASHWORTH, D.S.O., D.F.C., R.A.F.O., No. 656 Sqn.
Flt. Lt. J. H. BARNICOAT, D.F.C., R.A.F.V.R., No. 162 Sqn.
Flt. Lt. L. BENNETT, D.F.C., R.A.F., No. 1409.
Flt. Lt. A. O. J. BISHOP, D.F.C., R.A.F.V.R., No. 109 Sqn.
Flt. Lt. N. C. CRESSWELL, D.F.C., R.A.F.V.R., No. 109 Sqn.
Flt. Lt. E. L. D. DRAKE, D.F.C., R.A.F.V.R., No. 105 Sqn.
Flt. Lt. C. M. ROSTRON, D.F.C., R.A.F.V.R., No. 105 Sqn.
Flt. Lt. H. L. FORREST, D.F.C., R.C.A.F., No. 162 Sqn.
Flt. Lt. K. C. SMITH, D.F.C., R.C.A.F., No. 571 Sqn.
Flt. Lt. V. E. STUCHBERY, D.F.C., R.A.F.V.R., No. 105 Sqn.
Flt. Lt. F. A. TAYLOR, D.F.C., R.A.F.V.R., No. 105 Sqn.
Flt. Lt. P. J. WHEELER, D.F.C., R.A.F.V.R., No. 105 Sqn.
Act. Flt. Lt. B. A. JARVIS, D.F.C., R.A.F.V.R., No. 109 Sqn.
Act. Flt. Lt. A. McK. WOOD, D.F.C., R.A.F.V.R., No. 105 Sqn.
F/O. N. GILROY, D.F.C., R.A.F.V.R., No. 1409 Flt.
F/O. G. W. HODGES, D.F.C., R.A.F.V.R., No. 156 Sqn.

Distinguished Flying Cross

Act. Sqn. Ldr. J. R. SHEPHERD, R.A.F.V.R., No. 110 Sqn.
Flt. Lt. P. BROWN, R.A.F.V.R., No. 110 Sqn.
Flt. Lt. J. D. DUNBAR, R.A.F.V.R.
Flt. Lt. A. J. JACOMB-HOOD, R.A.F.V.R., No. 47 Sqn.
Flt. Lt. G. H. JONES, R.A.F.V.R., No. 684 Sqn.
Flt. Lt. D. D. WARWICK, R.A.F., No. 684 Sqn.
F/O. D. P. THOMPSON, R.A.F.V.R., No. 47 Sqn.
F/O. W. R. WILLIAMS, R.A.F.V.R., No. 28 Sqn.
W/O. W. G. BANNISTER, R.A.F.V.R., No. 684 Sqn.
W/O. W. BOX, R.A.F.V.R.
W/O. R. L. LOWMAN, R.A.F.V.R., No. 47 Sqn.
Sqn. Ldr. G. W. MOSHER, R.C.A.F., No. 203 Sqn.
Flt. Lt. B. D. MADILL, R.C.A.F., No. 123 Sqn.
Flt. Lt. J. A. RUSSELL, R.C.A.F., No. 203 Sqn.
Capt. J. KLONPJE, S.A.A.F., No. 13 Sqn. (with effect from Aug. 19, 1944).
F/O. J. S. COOKSEY, R.A.F.V.R., No. 61 Sqn.
F/O. P. O. FALCONER, R.A.F.V.R., No. 239 Sqn.
F/O. A. E. HAZEL, R.A.F.V.R., No. 207 Sqn.
F/O. F. D. JONES, R.A.F.V.R., No. 50 Sqn.
F/O. P. H. KEEN, R.A.F.V.R., No. 57 Sqn.
F/O. F. W. LOMAS, R.A.F.V.R., No. 223 Sqn.
F/O. H. E. MORRIS, R.A.F.V.R., No. 83 Sqn.
F/O. J. PATTERSON, R.A.F.V.R., No. 83 Sqn.
F/O. L. W. WATERS, R.A.F.V.R., No. 157 Sqn.
F/O. F. MacK. WATSON, R.A.F.V.R., No. 223 Sqn.
W/O. G. W. COPLAND, R.A.F.V.R., No. 514 Sqn.
W/O. J. FORRESTER, R.A.F.V.R., No. 83 Sqn.
W/O. D. TAYLOR, R.A.F.V.R., No. 157 Sqn.
Flt. Lt. J. H. KITT, R.A.A.F., No. 83 Sqn.
Act. Flt. Lt. D. C. HUXTABLE, R.A.A.F., No. 463 (R.A.A.F.) Sqn.
Act. Flt. Lt. J. H. M. McKERN, R.A.A.F., No. 463 (R.A.A.F.) Sqn.
Act. Flt. Lt. I. A. SIMPSON, R.A.A.F., No. 640 Sqn.
F/O. L. C. PEART, R.A.A.F., No. 463 Sqn.
Act. Sqn. Ldr. W. J. SMITH, R.C.A.F., No. 408 (R.C.A.F.) Sqn.
Act. Flt. Lt. R. V. BEST, R.C.A.F., No. 10 Sqn.
Act. Flt. Lt. S. G. E. CHABOT, R.C.A.F., No. 425 (R.C.A.F.) Sqn.
Act. Flt. Lt. T. S. FORBES, R.C.A.F., No. 100 Sqn.
F/O. J. C. P. BOYER, R.C.A.F., No. 425 (R.C.A.F.) Sqn.
F/O. A. L. SPENCE, R.C.A.F., No. 434 (R.C.A.F.) Sqn.
F/O. H. M. WHITTLES, R.C.A.F., No 408 (R.C.A.F.) Sqn.
P/O. M. J. V. BOURDON, R.C.A.F., No 425 Sqn.
Flt. Lt. T. P. RYAN, R.N.Z.A.F., No 85 Sqn.
Flt. Lt. F. D. WIN, R.N.Z.A.F., No 85 Sqn.
F/O. W. L. COMBS, R.N.Z.A.F., No. 514 Sqn.
F/O. A. J. JEEVES, R.N.Z.A.F., No. 640 Sqn.
F/O. B. A. MURRAY, R.N.Z.A.F., No. 640 Sqn.
F/O. D. R. SADGROVE, R.N.Z.A.F., No. 75 (N.Z.) Sqn.
F/O. J. W. HOWARD, R.C.A.F., No. 78 Sqn.
F/O. R. A. LOW, R.C.A.F., No. 101 Sqn.
F/O. P. J. PARSONS, R.C.A.F., No. 424 (R.C.A.F.) Sqn.
F/O. A. D. ROSS, R.C.A.F., No. 103 Sqn.
F/O. E. L. SMITHMAN, R.C.A.F., No. 433 (R.C.A.F.) Sqn.
F/O. G. H. WISSLER, R.C.A.F., No. 424 (R.C.A.F.) Sqn.
W/O. S. F. CAMPBELL, R.C.A.F., No. 419 (R.C.A.F.) Sqn.
Act. Flt. Lt. E. J. ABRAHAM, R.N.Z.A.F., No. 75 (N.Z.) Sqn.
F/O. A. D. SIMPSON, R.N.Z.A.F., No. 75 (N.Z.) Sqn.
F/O. R. S. TAIT, R.N.Z.A.F., No. 75 (N.Z.) Sqn.
Act. Sqn. Ldr. F. C. BALLANTINE, R.A.F.V.R., No. 10 Sqn.
Act. Sqn. Ldr. A. D. STEPHENSON, R.A.F.O., No. 100 Sqn.
Flt. Lt. E. G. COOK, R.A.F.V.R., No. 622 Sqn.
Flt. Lt. J. A. COSTELLO, D.F.M., R.A.F.V.R., No. 463 (R.A.A.F.) Sqn.
Flt. Lt. G. E. DURY, R.A.F.V.R., No. 150 Sqn.
Flt. Lt. W. L. HARLOW, R.A.F.V.R., No. 218 Sqn.
Flt. Lt. F. H. HARRISON, D.F.M., R.A.F.V.R., No. 97 Sqn.
Flt. Lt. S. A. HIDER, R.A.F.V.R., No. 85 Sqn.
Flt. Lt. K. L. HUGHES, R.A.F., No. 57 Sqn.
Flt. Lt. A. D. JORDAN, R.A.F.V.R., No. 78 Sqn.
Flt. Lt. G. A. KENNEDY, R.A.F.V.R., No. 171 Sqn.
Flt. Lt. C. K. NOWELL, R.A.F.V.R., No. 85 Sqn.
Flt. Lt. N. W. PENNEY, R.A.F.V.R., No. 106 Sqn.
Flt. Lt. L. SCHOLFIELD, R.A.F.V.R., No. 157 Sqn.
Flt. Lt. G. G. SCOTT, R.A.F.V.R., No. 10 Sqn.
Flt. Lt. S. N. SLOAN, C.G.M., R.A.F.V.R., No. 158 Sqn.
Act. Flt. Lt. E. M. AMATT, R.A.F.V.R., No. 61 Sqn.
Act. Flt. Lt. J. D. K. CROOKS, R.A.F.V.R., No. 514 Sqn.
Act. Flt. Lt. W. R. KENNEDY, R.A.F.V.R., No. 49 Sqn.
Act. Flt. Lt. G. McN. NORBURY, R.A.F.V.R., No. 83 Sqn.
Act. Flt. Lt. T. H. STEELE, R.A.F.V.R., No. 50 Sqn.
Act. Wing Cdr. W. J. SMITH, R.A.F.O., No. 218 Sqn.
Act. Sqn. Ldr. F. C. BELASCO, R.A.F.V.R., No. 207 Sqn.
Act. Sqn. Ldr. G. E. POULTON, R.A.F.V.R., No. 239 Sqn.
Flt. Lt. R. A. HERBERT, R.A.F.V.R., No. 189 Sqn.
Flt. Lt. M. W. HUGGINS, R.A.F., No. 615 Sqn.
Flt. Lt. W. A. VERRALLS, R.A.F.V.R., No. 207 Sqn.
Flt. Lt. H. F. WARWICK, R.A.F.V.R., No. 218 Sqn.
Act. Flt. Lt. G. A. HAMILTON, R.A.F., No. 97 Sqn.
Act. Flt. Lt. W. P. JOLLY, D.F.M., R.A.F.V.R., No. 15 Sqn.
Act. Flt. C. P. SMITH, R.A.F.V.R., No. 10 Sqn.
F/O. E. R. BROWN, R.A.F.V.R., No. 83 Sqn.
F/O. F. FERNLEY, R.A.F.V.R., No. 186 Sqn.
F/O. D. W. MARTIN, R.A.F.V.R., No. 186 Sqn.
F/O. K. R. RICHARDSON, R.A.F.V.R., No. 106 Sqn.
F/O. K. L. WORDEN, R.A.F.V.R., No. 463 (R.A.A.F.) Sqn.
P/O. R. SWIFT, R.A.F.V.R., No. 514 Sqn.
P/O. B. C. TREAGUS, R.A.F.V.R., No. 115 Sqn.
W/O. H. R. G. ABERNETHY, R.A.F.V.R., No. 97 Sqn.
W/O. A. KING, R.A.F.V.R., No. 51 Sqn.
W/O. J. C. WOOLLEY, R.A.F.V.R., No. 157 Sqn.
Flt. Lt. H. R. HOARE, R.A.A.F., No. 466 Sqn.
Flt. Lt. K. D. McRAE, R.A.A.F., No. 463 (R.A.A.F.) Sqn.
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Act. Flt. Lt. D. S. BRYSON, R.A.A.F., No. 83 Sqn.
F/O. H. R. ANDERSON, R.A.A.F., No. 462 (R.A.A.F.) Sqn.
F/O. L. C. SLADE, R.A.A.F., No. 57 Sqn.
P/O. J. R. STOKES, R.A.A.F., No. 467 (R.A.A.F.) Sqn.
W/O. E. L. HENRY, R.A.A.F., No. 15 Sqn.
W/O. L. R. HIBBARD, R.A.A.F., No. 57 Sqn.
Flt. Lt. A. P. R. HOLMES, R.C.A.F., No. 432 (R.C.A.F.) Sqn.
Flt. Lt. M. W. McLAUGHLIN, R.C.A.F., No. 419 (R.C.A.F.) Sqn.
Act. Flt. Lt. K. A. CARLYLE, R.C.A.F., No. 49 Sqn.
Flt. Lt. L. E. CLABAHAN, R.C.A.F., No. 408 (R.C.A.F.) Sqn.
F/O. P. H. FLEWWELLING, R.C.A.F., No. 207 Sqn.
F/O. J. R. GORDON, R.C.A.F., No. 420 (R.C.A.F.) Sqn.
F/O. N. D. MACDONALD, R.C.A.F., No. 640 Sqn.
F/O. A. A. NOBERT, R.C.A.F., No. 425 (R.C.A.F.) Sqn.
W/O. A. C. BYERS, R.C.A.F., No. 425 (R.C.A.F.) Sqn.
F/O. M. L. T. HARPER, R.N.Z.A.F., No. 9 Sqn.
Act. Wing Cdr. E. L. HANCOCK, R.A.F.V.R., No. 186 Sqn.
Flt. Lt. P. A. BENNETT, R.A.F.V.R., No. 57 Sqn.
Flt. Lt. J. A. V. GRISWOOD, R.A.F.V.R., No. 85 Sqn.
Flt. Lt. H. GRAYSON, R.A.F.V.R., No. 189 Sqn.
Flt. Lt. R. A. HORNER, R.A.F.V.R., No. 218 Sqn.
Flt. Lt. A. S. JONES, R.A.F.V.R., No. 625 Sqn.
Flt. Lt. T. B. ODDIE, R.A.F.V.R., No. 149 Sqn.
Flt. Lt. A. WINWOOD-SMITH, R.A.F.V.R., No. 83 Sqn.
Act. Flt. Lt. J. L. C. BRISCOE, R.A.F.V.R., No. 233 Sqn.
Act. Flt. Lt. J. R. W. OBE, R.A.F.V.R., No. 625 Sqn.
Act. Flt. Lt. A. G. PORTWAY, R.A.F., No. 186 Sqn.
Act. Flt. Lt. W. A. WRIGHT, R.A.F., No. 138 Sqn.
F/O. D. AYLARD, R.A.F.V.R., No. 90 Sqn.
F/O. C. S. BALDWIN, R.A.F.V.R., No. 77 Sqn.
F/O. J. S. BELL, R.A.F.V.R., No. 166 Sqn.
F/O. W. J. BREEZE, R.A.F.V.R., No. 103 Sqn.
F/O. W. S. BUTTON, R.A.F.V.R., No. 576 Sqn.
F/O. H. E. CLARK, R.A.F.V.R., No. 189 Sqn.
F/O. T. W. J. CLARKE, R.A.F.V.R., No. 138 Sqn.
F/O. W. L. COCKBURN, R.A.F.V.R., No. 83 Sqn.
F/O. G. E. G. FOSTER, R.A.F.V.R., No. 15 Sqn.
F/O. G. GINN, R.A.F.V.R., No. 218 Sqn.
F/O. R. McM. GOURLAY, R.A.F.V.R., No. 15 Sqn.
F/O. J. HYLAND, R.A.F.V.R., No. 148 Sqn.
F/O. T. L. JONES, R.A.F.V.R., No. 90 Sqn.
F/O. C. G. KEYTE, R.A.F.V.R., No. 166 Sqn.
F/O. J. E. LUBRAN, R.A.F.V.R., No. 90 Sqn.
F/O. D. P. MILLARD, R.A.F.V.R., No. 51 Sqn.
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Flt. Sgt. J. HAYTON, R.A.F.V.R., No. 156 Sqn.
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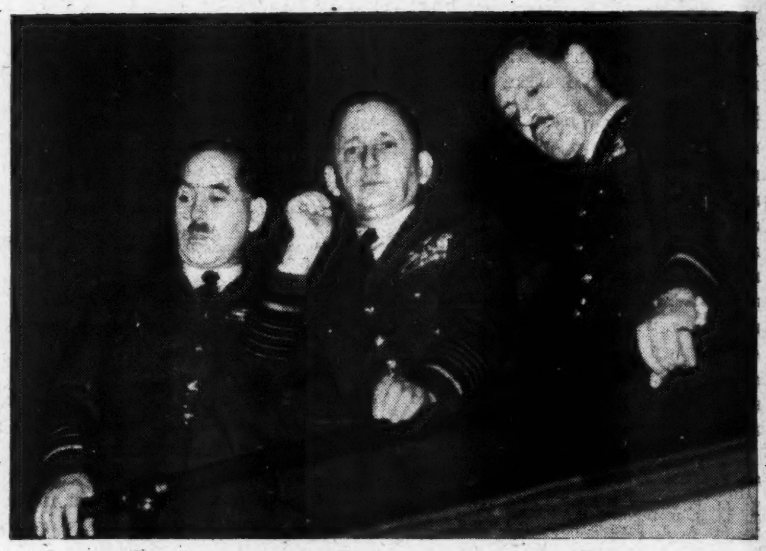

ONLOOKERS: Three well-known R.A.F. personalities photographed at the United Nations Organisation Conference, Westminster. They are, left to right, Air Chief Marshal Sir Guy Garrod, Marshal of the Royal Air Force, Sir Arthur Tedder, and Air Marshal Sir Roderic Hill.

THE KING has been graciously pleased to approve the following awards:

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Act. Wing Cdr. W. R. A. KNOCKER, R.A.F.V.R.
W/O. R. J. ALEXANDER, R.A.F.V.R.

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Sgt. W. J. ROSE, R.A.F.V.R.
Cpl. J. W. WHYTE, R.A.F. Regt.
L/A/C. J. L. NORTHMORE, R.A.F. Regt.
L/A/C. S. G. WEBB, R.A.F. Regt.
Flt. Sgt. N. R. A. THOM, R.A.F.

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THE KING has granted unrestricted permission for the wearing of the undermentioned decoration conferred upon the officer indicated, in recognition of valuable services rendered in connection with the war:—

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Act. Air Vice-Marshal R. M. FOSTER, C.B., C.B.E., D.F.C., R.A.F.
Air Comdre. R. B. LEES, C.B., C.B.E., D.F.C., R.A.F.

Legion of Merit (Officer)

Air Vice-Marshal R. S. AITKEN, C.B.E., M.C., A.F.C., R.A.F.
Air Vice-Marshal B. MCENTEGART, C.B., C.B.E., R.A.F.
Air Vice-Marshal Sir V. H. TAIT, K.B.E., C.B., R.A.F.
Act. Air Comdre. J. A. EASTON, C.B.E., R.A.F.

Conferred by Her Majesty the Queen of the Netherlands

Militaire Willemsorde, 4th Class

Act. Sqn. Ldr. R. F. W. CLEAVER, D.S.O., D.F.C., R.A.F.V.R.

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Wing Cdr. R. J. M. BANGAY, R.A.F.
Wing Cdr. J. A. SPROULE, D.F.C.
Act. Wing Cdr. C. D. NORTH-LEWIS, D.S.O., D.F.C., R.A.F.
Act. Wing Cdr. G. F. H. WEBB, A.A.F.
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F/O. R. G. CULLEN, R.A.F.V.R.
F/O. F. T. POWELL, R.A.F.V.R.

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Act. Air Comdre. A. H. WHEELER, O.B.E., R.A.F.
Act. Group Capt. W. E. SURPLICE, R.A.F.
Act. Wing Cdr. E. L. ARCHER, D.S.O., A.F.C., R.A.F.V.R.
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Flt. Lt. E. G. IRELAND, D.F.C.
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F/O. J. P. E. DE CHAMPLAIN.
F/O. J. F. ELLIS.
F/O. D. S. SELLARS.
P/O. W. P. STEWART.

Conferred by His Majesty the King of Norway

Order of St. Olav, Second Class with Star

Act. Air Vice-Marshal J. A. BORET, C.B.E., M.C., A.F.C., R.A.F.

Conferred by the President of the Republic of Poland

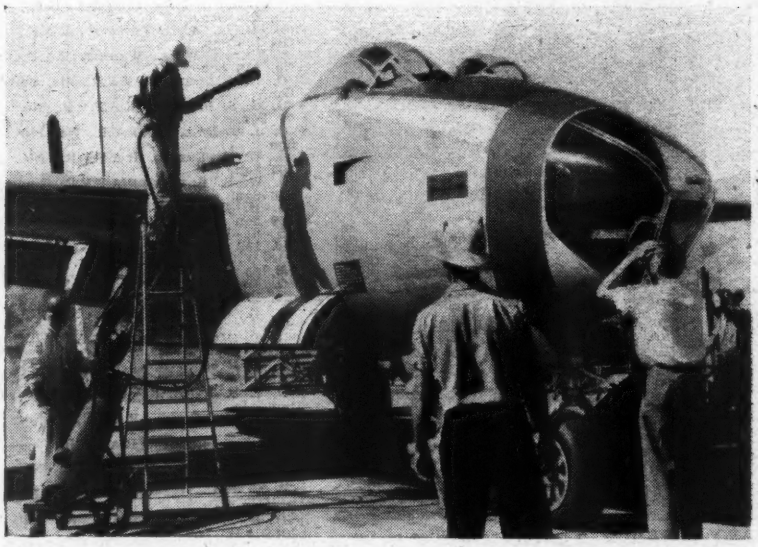
Cross of Valour

Act. Sqn. Ldr. F. J. B. KEAST, D.F.C., R.A.F.

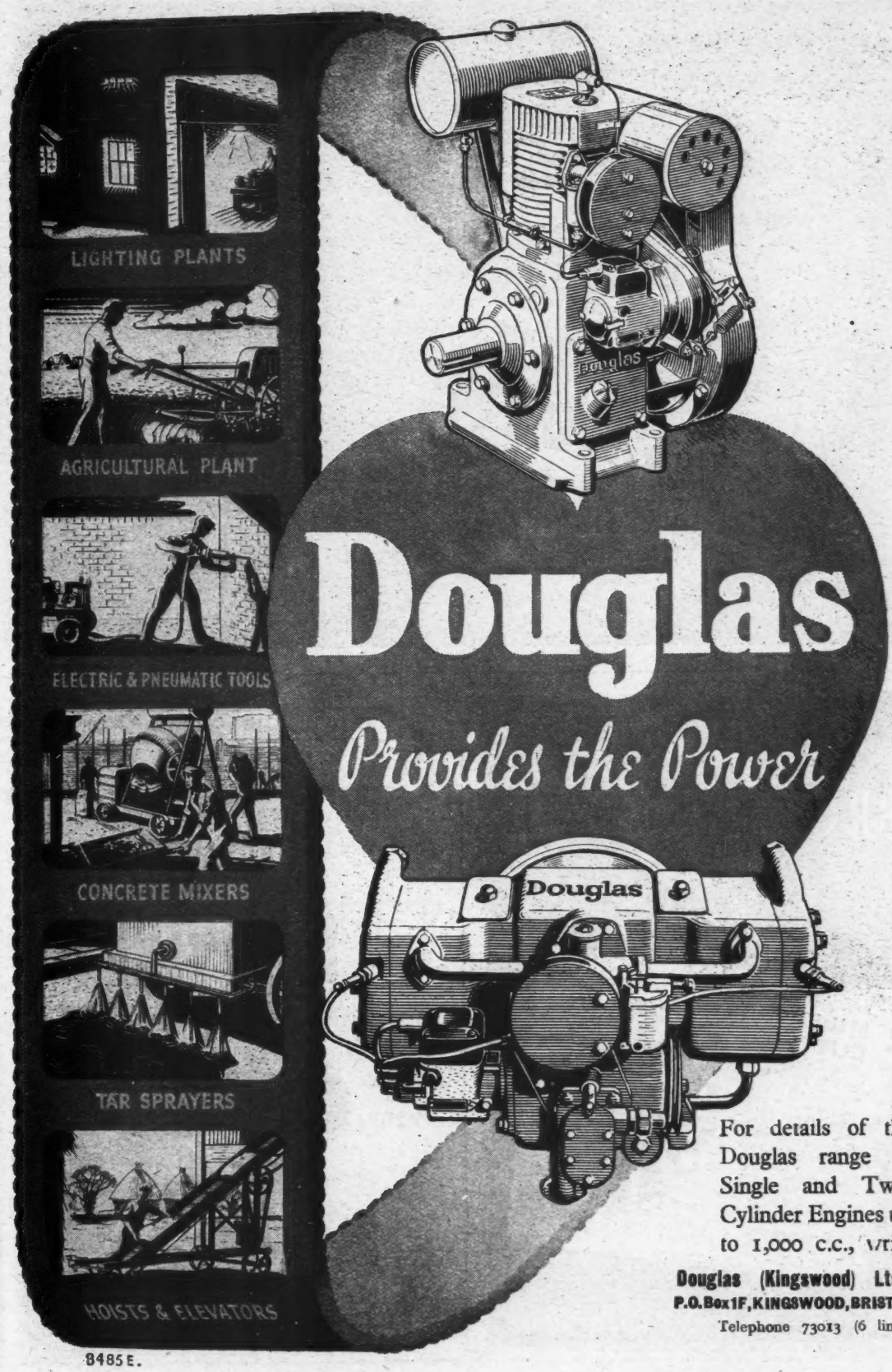
Conferred by the President of the Czechoslovak Republic

Order of the White Lion (Fourth Class)

Act. Wing Cdr. H. L. SELIGMAN, R.A.F.V.R.



THE MIXMASTER: This photograph shows well the twin cockpits of the Douglas XB-42, one of the most unusual aircraft to be revealed of late, which recently crashed. A civil development, the DC-8, will carry up to 48 passengers.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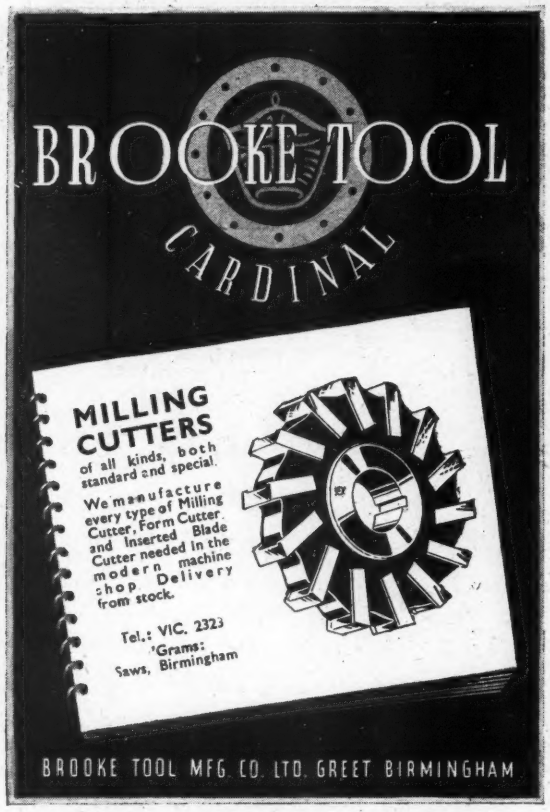
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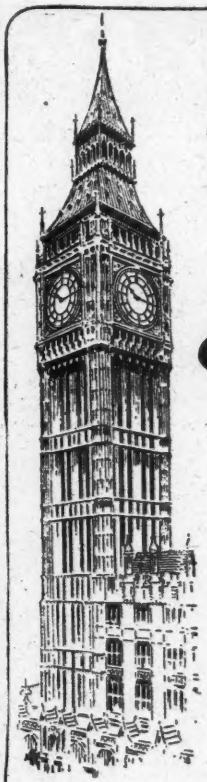

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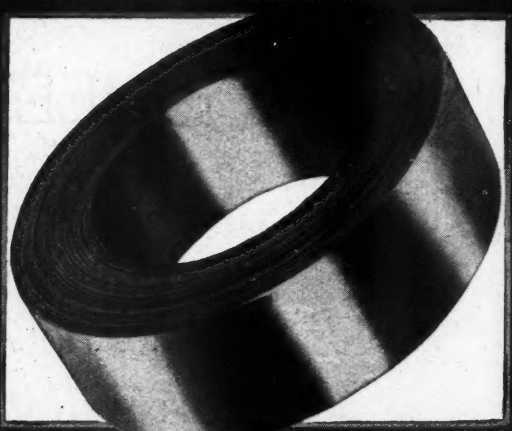

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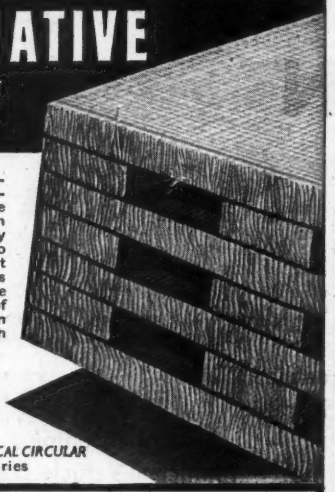

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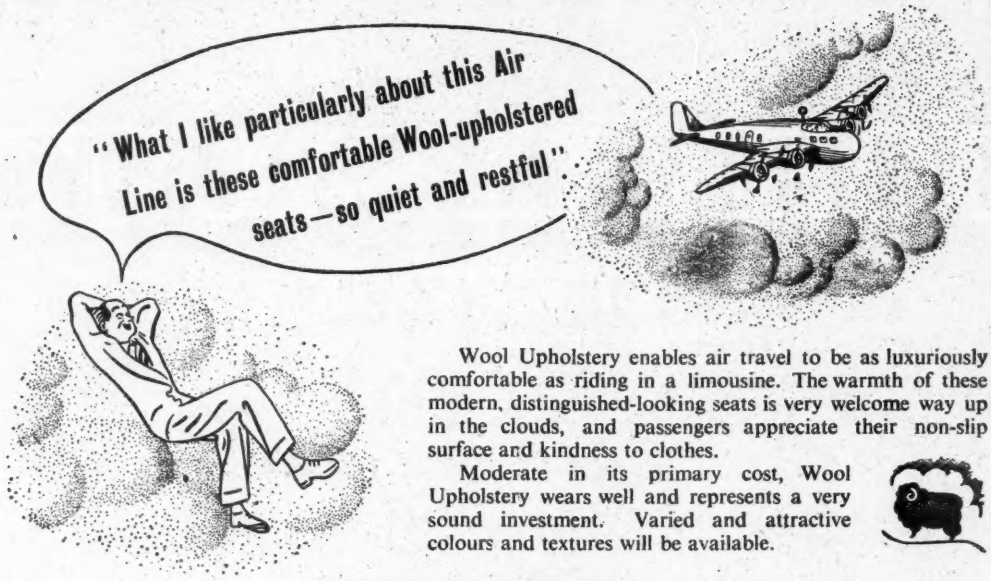

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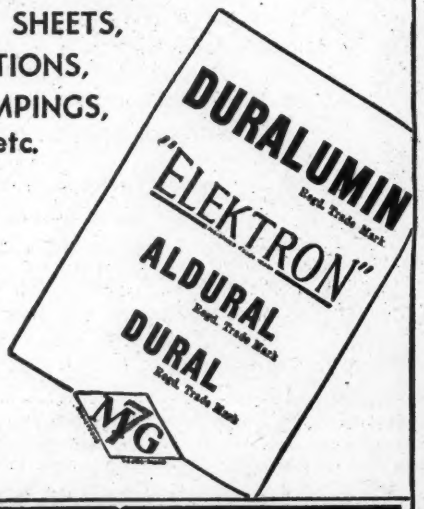

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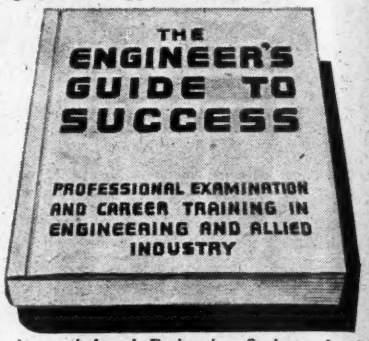

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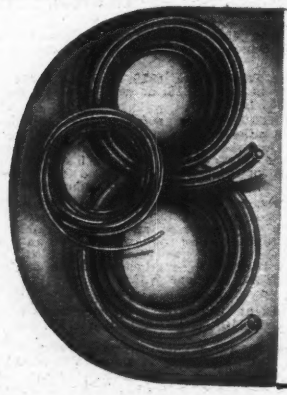

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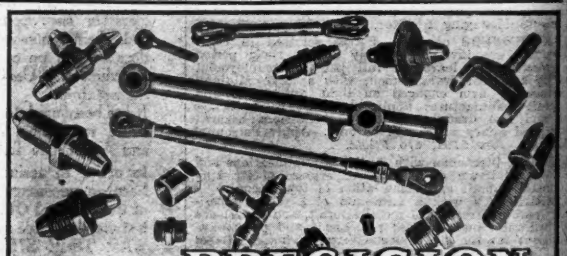

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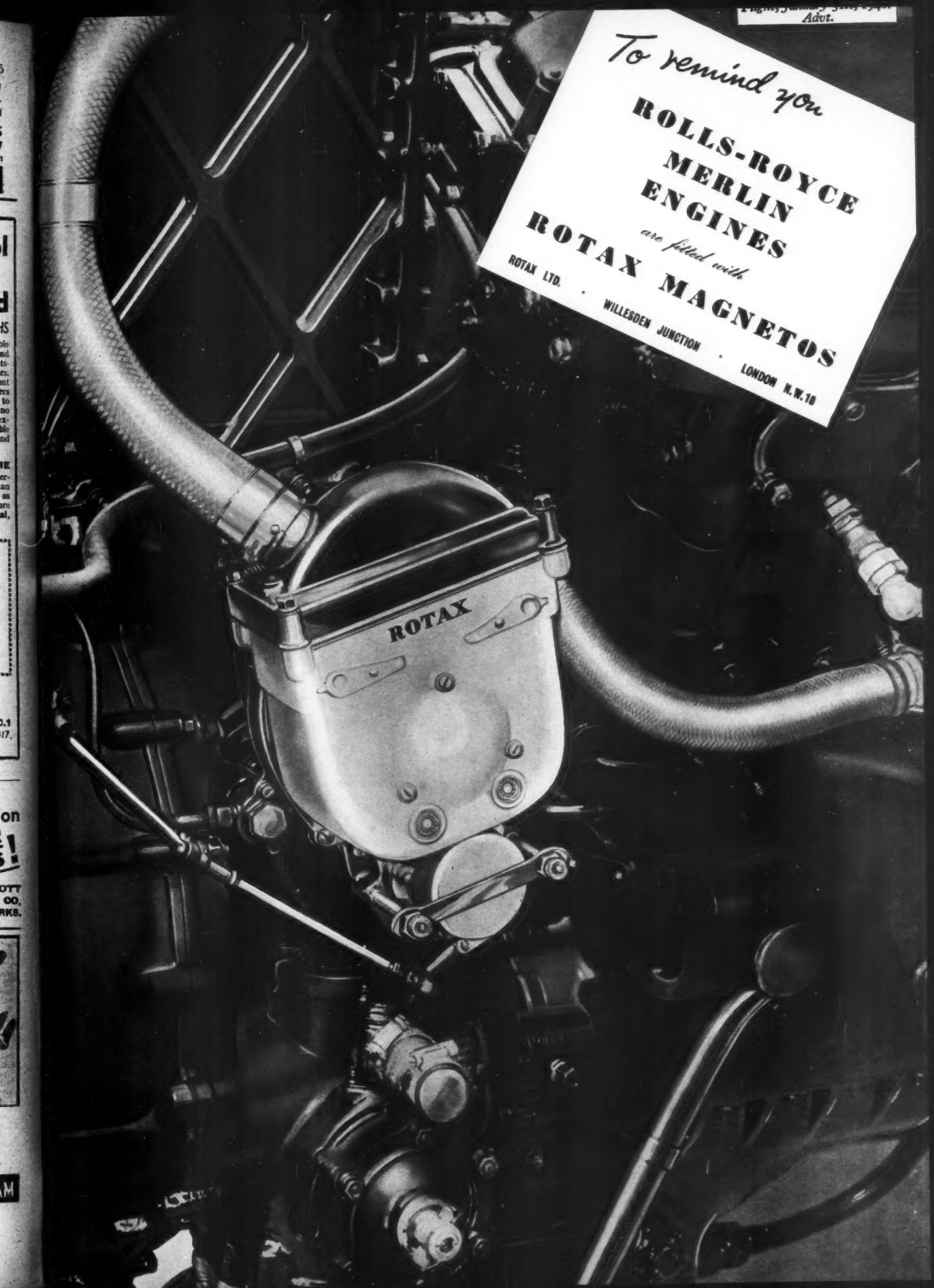
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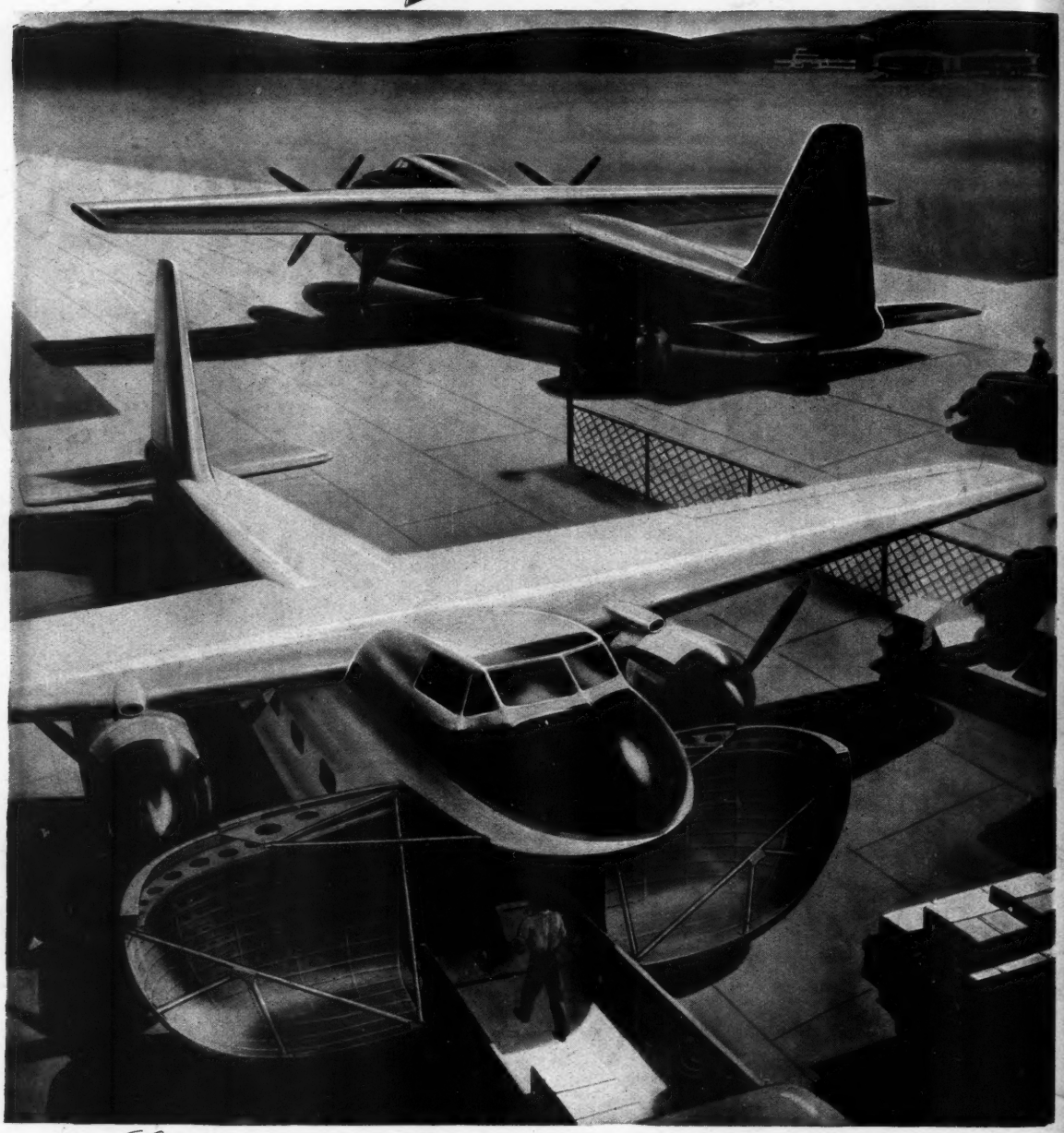

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